Managing Scientific and Technical Information in Environmental Cases

Principles and Practices for Mediators and Facilitators

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I. Preface

This effort represents ideas gathered from more than a hundred individuals[1] as well as a review of some, though certainly not all, of the relevant literature.[2] The document is an initial attempt to distill and disseminate those key principles and practices that are relevant to managing scientific and technical information in environmental conflicts. Through this project, we hope to advance both the practice and theory of environmental mediation and to launch further thinking and discussion on the issues raised.

The information age has increased the pace of information development, dissemination, and application. As more scientific information enters the public domain, it is increasingly important to use science wisely and to understand its interactions with other modes of thought and inquiry. We hope this sourcebook will be helpful to that end.

Readers are encouraged to freely use and disseminate this document but are asked to credit the authors and the sponsors of this project—RESOLVE, Inc.; the U.S. Institute for Environmental Conflict Resolution (USIECR); and the Western Justice Center Foundation.

- Based in Washington, D.C., and Portland, Oregon, the nonprofit RESOLVE, Inc., www.resolv.org, specializes in environmental dispute resolution, environmental mediation, consensus building, facilitation, and policy dialogue. RESOLVE is a leader in mediating solutions to controversial problems and broadening the techniques for consensus building on public policy issues. RESOLVE is dedicated to improving dialogue and negotiation between parties to solve complex public policy issues and to advancing both research and practice in the dispute resolution field. RESOLVE works in the U.S. and abroad. 1255 23rd Street, NW, Suite 275, Washington, D.C. 20037. Phone: (202) 965-6390; fax: (202) 338-1264.
- Based in Tucson, Arizona, the U.S. Institute for Environmental Conflict Resolution, www.ecr.gov, assists parties across the country in resolving environmental conflicts that involve federal agencies or interests. Operating under the aegis of the Morris K. Udall Foundation, the Institute offers expertise, guidance, and training in environmental conflict assessment, facilitation, and mediation. The Institute maintains a network of programs and practitioners around the country who can be called on to assist in environmental conflict resolution. 110 South Church Avenue, Suite 3350, Tucson, Arizona 85701. Phone: (520); fax: (520) 670-5530.
- The mission of the nonprofit Western Justice Center Foundation, www.westernjustice.org, is to create and enhance models for resolving conflict; improve the quality of justice and appropriate uses of the legal system; create knowledge through research and evaluation; and instill conflict resolution skills in children. The Western Justice Center conducts programs in California, across the nation, and abroad, all in collaboration with carefully selected partner groups. 85 South Grand Avenue, Pasadena, California 91105. Phone: (626) 584-7494; fax (626) 568-8223.

This document is located on the Web sites of these three organizations and also of the Society of Professionals in Dispute Resolution and Policy Consensus Initiative. Other organizations and agencies are encouraged to post it on their Web sites and to disseminate it as they wish. Readers are also encouraged to contact any members of the working group to contribute further thoughts and comments.

The authors intend for this document to be accessed in any ways that readers find most valuable. Some might prefer to read it from beginning to end as a narrative. Alternatively, others will use it as a reference manual, focusing on portions that they find relevant to a past or present challenge. The organization of the document is intended to accommodate either objective.

After this preface, the paper begins by presenting the central challenges in dealing with science and technical information in environmental cases. Then it presents the specific challenges that stakeholders and mediators identified in the literature and focus groups. The fourth section outlines some key ideas and practice principles underlying the more specific guidelines in the fifth section. The sixth section consists of "how to's" and "to do's" from experienced environmental and public policy mediators. The endnotes include information on the origins of this project. Appendices include information on how to contact the working group; a list of participants and contributors, for whose encouragement, expertise and insights the authors are most grateful; and selected readings.

II. The Challenge

> "In a major move to protect wildlife in old growth forests, a judge has halted nine federal timber sales in the Pacific Northwest and ordered further reviews that could stop logging in large sections of Washington, Oregon, and California." ("Judge Halts 9 Northwest Timber Sales," wire report in ***The Spokesman-Review***, Spokane, Washington, August 4, 1999.)
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> "A Federal investigation has concluded that a scientist at the Lawrence Berkeley Laboratory in Berkeley, Calif., faked what had been considered crucial evidence of a tie between electric power lines and cancer." (William J. Broad, "Data Tying Cancer to Electric Power Found to be False," ***The New York Times***, July 24, 1999.)
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> "More than a century and a half after it was built, the Edwards Dam made a new mark in history as the first dam the federal government demolished against the wishes of its owners." (Traci Watson, "After 162 Years, Maine River Finally Running Free," ***USA Today***, July 2, 1999.)

Environmental disputes pose powerful challenges to civil societies. More often than not, they are complex and hard fought affairs that present urgent and practical problems to be solved. Frequently, they are laden with contested scientific and technical information and important collisions of social and economic values. Inevitably, they are also political fault lines in larger ideological wars.

At the start of the 21st Century, citizens and decision-makers are hungry for ways to improve environmental discussions. As a country, we need wiser outcomes that are conceptually more sound, explicitly equitable, and that have practical staying power. Simultaneously, we need to reduce the transaction costs (both human and financial) that are associated with public interest conflicts over timber, land, water, hunting, pollution, fishing, and energy development, to mention just a few.

The use of strategies based on "joint gains," problem solving, mediation, facilitation, and consensus building offer promise for many cases. While these approaches are not a panacea, thousands of significant cases involving public health, public lands, and natural resources have been successfully mediated or facilitated since the early 1970s. This includes "upstream" cases when rules and policies are being made and "downstream" issues when parties are involved in enforcement and compliance.[3] The authors and sponsors of this document believe many more cases could be wisely and amicably resolved if good scientific and technical information were better integrated into the search for solutions.

While the term "joint gains" problem solving suggests that a rational, interest-based approach to problem solving is inherently useful, many environmental disputes also are driven by personal and political factors. Nonetheless, at core, they often focus on any of several questions:

- Who bears responsibility for something that allegedly went wrong environmentally?
- How shall a current condition that is harmful be remedied?
- Will a proposed project, policy, or rule prove potentially deleterious to human or environmental health?

- How should an environmental resource with its attendant issues of risks, costs, and benefits, be managed into the future?

Environmental conflicts often tend to be broad in their scale of impacts and laden with values that are seemingly at odds. Environmental disputes are also emotional. The parties may include both "conscience" as well as "beneficiary" constituents. At issue in many cases are matters of culture, economics, justice, health, risk, jobs, power, uncertainty, and professional and

While multiple stakeholders compete for limited water resources, one body of water can serve many different interests. For example, this is a marina of pleasure boats on Lake Lanier, north of Atlanta, Georgia. These waters provide not only drinking water and electricity for hundreds of thousands of people, but also a year-round, aquatic playground. The lake is really a reservoir built by the U.S. Army Corps of Engineers in the 1950s to control river flooding that used to occur downstream. Courtesy, U.S. Geological Survey.

bureaucratic politics. Elections are sometimes won or lost because of environmental conflicts. In some cases, the outcomes of specific conflicts have inter-generational or global impacts.

When specific controversies in any or all of these areas emerge, advocates, policy makers, and adjudicators look to science and technical experts to help improve their decisions. Scientific data and knowledge also form the building blocks necessary to ground consensus-seeking deliberations. The kind of science-based information that is available and how it is used are important factors in helping the parties affected by a decision to gain confidence in the process and the outcome.

In the abstract, infusing high quality information into a controversy and having it serve as a foundation for decision-making should be a straightforward matter. One asks the right questions, obtains data through rigorous and accepted methods, analyzes and interprets the data in ways that are logical, and then submits the findings to peer review. Unfortunately, information rarely threads into solutions in such a direct way.

More often, information gathering is done by warring experts as part of an adversarial and contentious process tinged with suggestions of actual or implied litigation. Productive lines of communication are often severed. In other cases, vital information is an afterthought to the economics and politics of deal making. Alternatively, vast amounts of money may be spent on irrelevant or unusable research in information collection. Surprisingly often, disagreements on key points remain unresolved and uncertainties that can undermine the future stability of an agreement are left unaddressed.

Some of the confusion and complexity of environmental conflict is directly attributable to the way information is organized, interpreted, communicated, and differentially judged to be useful. Government agencies, community groups, environmental advocates, academics, and businesses each approach the gathering and explication of data in their own way and with their own needs in mind. Moreover, different disciplines and professions implicitly value or devalue scientific information according to their training and the rules of their professional cultures.[4] The traditional means of grappling with this complexity tends to rely on adversarial legal and scientific truth seeking.

Joint gains approaches such as mediation and facilitation, however, also offer excellent forums for managing the tensions, crosscurrents, and data clashes in environmental conflicts. Organized properly, these processes can provide a powerful complement to the formal structures of governance and a promising set of tools for decision-makers. However, those who advocate for these processes and those who participate in them, those who pay for them and those who use them, need to develop stronger, more self-conscious and more coordinated approaches to the gathering, sorting, integrating, packaging, and interpreting of information. Ideas and tools in this somewhat specialized area are essential and this document attempts to address that need.

At the onset of this project, we hoped to illuminate a set of questions that are, in part, practical, technical, and procedural and that, in others ways, reflect our differing and intellectually incomplete understanding of the dynamics of environmental conflict. All of the questions center on the role of the third party as he or she attempts to provide management and choreography of scientific and technical information in environmental cases. The questions, along with the materials itself, are not meant to be definitive. They offer a starting point for additional inquiry.

1. What exactly are the different roles scientific and technical information plays in environmental conflicts? Do differences over science and technology actually ***cause*** environmental disputes or do they simply affect the way disputes and conflicts escalate and are handled?
2. When is science really relevant to the core issues in environmental conflicts? When is a dispute truly a "technical" dispute and under what circumstances is it irrelevant or a small side issue?
3. When and how do parties strategically frame disputes as being about science and technology in order to pursue their interests?
4. What is the appropriate role for mediators and facilitators seeking to integrate science and technology into their processes? Conventional conceptions of mediation and facilitation place a strong emphasis on process and relationship management. In science-intensive environmental disputes, should mediators play a stronger substantive role?
5. Beyond high quality communication, negotiation, and process management skills, what value-added tools and strategies can mediators and facilitators bring to the table that will increase the clarity, rigor, and likelihood of good decisions coming out? For example, should a mediator effectively press the issue of burden of scientific proof?

6. If there are logical rules-of-the-road for effectively integrating scientific and technological data into consensus-seeking processes, how insistent and forceful should one be in pressing them?
7. What is the responsibility of the mediator to help non-experts understand the science involved? Which tools and strategies can be employed without the mediator taking, or being seen as taking, a position on the issues?
8. How can mediators and facilitators help disputants effectively manage the warring or contested science that is often at issue in environmental cases? For example, in what ways might mediators and facilitators help disputants manage scientific and technical uncertainty and the balancing of the Precautionary Principle and doctrines of Reasonable Risk?[5]
9. How do you (and how should you) get scientists who are naturally resistant to making recommendations because of inconclusive data to "jump the breach" so that their work is useful in making practical decisions?
10. Is ***more*** or ***better*** scientific information always necessary to narrow the foundational factual issues?
11. Are some kinds of knowledge inherently more relevant than others in resolving environmental conflict? Within the different life sciences (e.g., chemistry, biology, ecology) and the social sciences (e.g., sociology, economics, anthropology), is there an overarching hierarchy of relevance to environmental issues that should be given primacy, or does it simply depend on the facts on hand in a given dispute?
12. Are there different roles for environmental mediators depending on whether the case is "upstream" or "downstream"?
13. In situations of disparate power, or where problems of environmental justice are at the forefront, should environmental mediators work with aggrieved parties using the same principles family mediators use with abused spouses? Should they be treated differently to empower them to participate in public debate?

III. Rockslides on the Road to Agreement

Triggered by the Northridge earthquake of January 1994, twin landslides block a road near the I-5 interchange with California State Highway 14. Landslides, rock falls and rockslides in the Santa Susana and western San Gabriel Mountains blocked many roads and thus hampered relief efforts and exacerbated transportation problems caused by the earthquake. Courtesy, U.S. Geological Survey.

Formally or informally, negotiating parties, environmental mediators, facilitators, and consensus-builders confront an extraordinary variety of problems and fact-patterns centering on the generation, management, interpretation, and use of scientific and technical information. This section presents some of the situations that confront negotiating parties and those who seek to assist them.[6]

1. **Multiple Disciplines**. There are various specialized sciences involved in providing critical scientific and technical information but the conclusions do not converge to a logical policy choice.

   Example: Environmental groups seek to prevent an agricultural operation from withdrawing additional water from an aquifer. Geologists and hydrologists find the water is available. Ecologists and wildlife biologists show that withdrawal will harm nearby stream biota. Sociologists and economists conclude that new farms revitalize an economically depressed area.

2. **Access to Data.** There is good scientific or technical information available but some or all of the parties have trouble accessing it. They cannot quite articulate what they need to know, how to identify it, or whom to contact.

   Example: Competing recreational users (hikers, horse riders, and bicycle riders) are engaged in a rule-making dispute over management practices in a multi-purpose wilderness area. Although the stakeholders are bright, intelligent people, they are highly positional and unaccustomed to these kinds of conflicts.

3. **Adequacy of Existing Data**. There is missing scientific or technical information that could be researched and brought to the table but the process of doing this needs to be organized and supported by adequate resources.

Example: A community group and a resort developer are in conflict over short- and long-term traffic impacts of a new golf course. The developer believes enough studies have been done. The community believes more are required.

4. **Unclear Significance**. Scientific or technical information is brought to bear on a given topic but the significance of it is unknown or of marginal value, or there is no technique or methodology to evaluate or compare the information.

   Example: Proponents and opponents use computer-generated pictures to simulate the proposed visual and aesthetic impacts of a series of micro-wave relay towers on a ridge over a park and residential community. People are intrigued with the pictures but some participants are not convinced that the simulations give them the information they need to make decisions.

5. **Restricted Data**. Several parties have critical information that could help resolve the matter but the data is confidential or proprietary.

   Example: Water well drilling permits must be issued by a certain date, or the project proponent will lose the opportunity to proceed. A government agency, different from the one issuing the permit, is unable to release its latest study of chloride buildup because it has not been approved for release. Simultaneously, the drilling company is fearful of disclosing trade secrets that might give its competitors an edge.

6. **Politicized Information**. There is salient scientific or technical information that could be brought to the table to enhance decision making but people perceive the information as skewed and overwhelmed by political spin and media hype.

   Example: Proponents and opponents are engaged in a dispute over improvements to a highway that is statistically safe but perceived to be dangerous. Numbers suggest that although the highway has a high proportion of dramatic accidents, the overall accident rate remains low. Citizen groups have taken out ads calling for expensive improvements. The city has appeared on talk shows arguing that the proposed improvements are expensive and will not make a difference.

7. **Lack of Expertise**. There is good scientific or technical information available and the parties think it could be relevant to their decision making but some or all of them do not understand it.

   Example: Various private and civic sector organizations come together to resolve opposing positions about a huge public expenditure over secondary and tertiary sewage treatment. They are confounded by complex and often conflicting toxicological, engineering, and ecological studies.

8. **Inconclusive Data**. The scientific or technical information disputants are relying on is spotty, does not show strong cause and effect relationships and does not invite an obvious decision. Conclusions can be suggested or inferred about cumulative effects but there is no completely logical basis for policy.

   Example: A large oil company is proposing to build a lengthy oil transmission line. They have done several studies, each time using slightly different assumptions and criteria in

order to find the best route. Based on these studies, and believing they have been responsive to various public interests, they re-routed their line several times. Opponents believe the line and its construction will contribute to fragmented habitats, non-point source pollution, and the disruption of several very small and fragile wetlands.

9. **Purchased Information**. Credible scientific or technical information is available but all of it has been commissioned or produced by some of the parties and is therefore distrusted by the others.

   Example: Several large manufacturing companies have been sued over the contamination of a river. The government agencies and citizen groups that are involved refuse to rely on the studies that the companies are using but have no funds to do their own.

10. **Uncertainty and Division among the Scientists**. Despite great amounts of advocacy, research, and applied studies, massive scientific and technical uncertainty remains. Peer reviewed studies are equivocal and the opinions of credible experts are deeply divided.

    Example: In a conflict over the construction and routing of new transmission lines, an electric company cannot avoid bringing their lines through certain residential areas. Credible evidence is presented on both sides about electro-magnetic frequencies as a cancer cause.

11. **Distrusted Science**. There is a fair amount of scientific and technical information available but the science itself is distrusted.

    Example: Local food producers propose to build a food irradiation facility to control insect infestations in export fruit and to reduce the risks of ***E. coli*** outbreaks. Anti-nuclear opponents organize to defeat the proposal. They believe that the use of radiation will poison their food.

12. **Irrelevant Information**. Scientific and technical information exists and the parties know it exists but they choose not to examine it. They believe the information is irrelevant to reaching an agreement or there is no practical solution to the problems of conflicting interpretations.

    Example: Government agencies and environmental groups sue several industries over the removal of PCBs from river sediments. There are major scientific and factual disagreements over the levels of PCB contamination that actually warrants action. There are also disagreements about the amount of sediment that has been deposited on the river bottom and bank? Plaintiffs and defendants agree to a settlement that results in a cleanup with no admissions of liability.

13. **Data Overload**. There is too much data at hand, and the data is either unorganized, or the volume of data overwhelms parties as they attempt to sort through what is relevant, synthesize it, and apply it to the problem at hand.

    Example: Various industry and public policy groups are involved in a rule making negotiation over microbial disinfectants. The data on human health, microbiology, chemistry, water quality, and treatment makes the rule making process time consuming and very diffi-

cult because there is so much information and so many complex relationships between the different kinds of information involved.

14. **Theory Unsupported by Sufficient Research**. Predictive scientific theories have been postulated but little or no empirical research has been done. While differing sides in a dispute resolution or conflict management process preoccupy themselves with arguing conjectural positions, government agencies have a compelling need to regulate.

    Example: After several cases of "Mad Cow Disease", policymakers determine that there is a need to create regulations on the beef industry. Theories about the origins and transmission of the disease exist but there is almost no research available to inform the regulatory process.

15. **Scientists Ahead of the Stakeholders**. Funds from a limited research budget are allocated by a government agency and studies are commissioned. Data are collected and analyzed. After the studies are completed, a stakeholder process is initiated.

    Example: State park officials concerned about the ecological impacts of recreational uses on a coastal island organize a series of scientific inquiries. After concluding their studies, the park officials gather together a stakeholder group that quickly identifies other kinds of data that are needed for regulation. Park officials have no budget left for gathering additional data.

16. **Information Not Yet Usable**. A time-sensitive problem needs to be resolved and all of the parties want to resolve it, but it requires specialized scientific information and/or new technological processes that are not fully developed and available.

    Example: A community pressures the commander of a military installation to clean up a disused training area that has unexploded W.W.II ordnance below the surface of the ground. Old methods of cleanup will be destructive to many environmentally and archeologically valuable sites. The military and the community agree on the goals and priorities for cleanup but the specific techniques needed for a low-impact cleanup will not be available for another eight years.

17. **Poor Issue Framing**. There is either an incorrect, incomplete, or competing framing of the problem in a manner that excludes critical value questions that are central to some of the parties.

    Example: Officials from a well-regarded research institution propose to build a large, multi-million dollar infrared telescope on the top of a mountain used by local hunters and hikers and held sacred by native people. The scientists are prepared to address mitigation but insist on using standard western scientific nomenclature and criteria for mitigation plans. Representatives of the native people do not believe their issues are being adequately discussed.

18. **Pseudo-Professional Posturing**. An expert attempts to dominate the presentation or interpretation of critical scientific or technical information but actually does not have expertise in that area.

Example: In settlement discussions over pollution damages, a lawyer exaggerates his grasp of the hydraulics involved in the migration of underground contamination. In those same discussions, scientists retained by the community are arguing constitutional questions.

19. **Shifting Conceptual Framework**. Data or technical information exists but the framework or paradigm for interpreting and understanding the meaning and relevance of the data is undergoing a significant knowledge shift.

    Example: Global warming scientists and policy makers have gathered to develop proposed policies that would dramatically affect business economics. Environmental advocates argue for stringent regulations to prevent ozone depletion and the buildup of greenhouse gasses. Representatives of major industries object.

20. **Unrealistic Expectations of Scientists**. Parties to a conflict assume that there is a technically correct solution to a problem that is causing great controversy. Once engaged, scientists and technical experts come up with multiple answers, none of which are wholly satisfying to any of the parties.

    Example: Environmentalists, farmers, loggers, and government officials are engaged in an acrimonious planning problem, one aspect of which is the adoption of in-stream flow standards. After a round of initial meetings, the working group engages a group of scientists who cannot give them a single answer.

A hydrologist testing for chlorofluorocarbons (CFCs), collects groundwater samples in a glass tube. Because exposure to air would contaminate the sample, he uses a flame to melt and seal the tube. Courtesy, U.S. Geological Survey.

21. **Outdated Data and Organizational Lag**. New research suggests that current standards could and should be changed. The agency responsible for undertaking such reviews is preoccupied with what they consider to be more important matters.

    Example: Small businesses that rely on a specific technology believe that a constituent metal should be de-listed as a toxic substance because new research indicates it is not a public health threat. De-listing would translate into economic efficiencies. The government agency responsible for small business sees this as a low-priority issue. They are willing to meet but not willing to take it up on their docket of rule-making issues.

22. **Differential Tolerance for Complexity**. Some parties are able to tolerate a great deal of technical complexity and scientific ambiguity. Others are impatient with the process. The disconnect leads to irritation, quarreling, and persistent fights over the production of useful and usable information.

Example: In a technically complex and long-running rule-making case over synthetic chemicals in food, scientists must analyze many different kinds of medical and public health data. They are insulted when busy, lay participants in the negotiation begin asking for a synthesis or the "short version". Conversely, the lay participants are running out of time, money, and the patience needed to engage in the process.

23. **Pseudo-Scientific Environmental Conflicts**. One or more of the parties to a conflict nests their issues in a contested scientific matter as a strategy or tactic for accomplishing other objectives. The core of the real dispute is about deeply held values.

    Example: Abutting neighbors oppose the construction of a municipal solid waste incinerator. Neighbors fear a drop in property values and increased (but still legal) levels of noise and traffic. Because the legal policy framework recognizes human health concerns, but not "inconvenience," as a legitimate basis for a negative decision, the community files suit alleging a deterioration of air and water quality.

IV. Key Concepts and Practice Principles

The theory and practice of environmental mediation derives from concepts in many fields and, increasingly, from research on actual cases. Some of this literature is referenced in Appendix C, Selected Readings. The following assumptions constitute some, though by no means all, of the elements of a framework for managing scientific information in environmental disputes. More directly, they are the building blocks for the rules of thumb and practice tips that follow in Sections V and VI.

Like all the others presented in this document, this particular list is neither conclusive nor exhaustive. It is offered as a specific addition to the customary methods and processes taught in training programs and found in the general literature on mediation, facilitation, and consensus building.

A. On the Nature of Knowledge

1. By itself, scientific and technical knowledge is neither a "be-all" nor "end-all" in environmental conflicts. Parties bring to the table different kinds of knowledge: "traditional" knowledge, "cultural" knowledge, "local" knowledge, and "remembered" knowledge, all of which have a place at the table in environmental conflict resolution.
2. All information (regardless of whether it is scientific, technical, traditional, cultural, local, or remembered in nature) is subject to questions about validity, accuracy, authenticity, and reliability. Every type of knowledge has standards of quality that can be examined, debated, or shaped. Thus, the issues of what is examined, how it is examined, who examines it, and when it is examined are negotiable.
3. Useful knowledge rarely remains static in the subject matters that come into play in environmental conflict. Knowledge builds off new questions and new information.[7]

Streamside in Central Arizona, working from her laptop, technician Karen Beaulieu downloads temperature and conductivity data from probes at a surface-water and aquatic biology monitoring site. Courtesy, U.S. Geological Survey.

4. Many lay people think science is conducted wholly in the realm of testable knowledge. Scientific methodology stresses experimentation and quantifiable conclusions: observation, hypothesis, experiment, and conclusion. Subjective knowledge, however, plays a larger role than many people know or that scientists will often admit to. Past experiences, intuition, hunches, values about what is important to know, and even bidding/betting processes like "Monte Carlo" analysis often enter into the scientific process, particularly in framing questions for research and data collection.

5. Scientific and technical research in the life, engineering, and social sciences rarely provides definitive and unequivocal answers. More often, knowledge is expressed in terms of probabilities, beta-weights, and standard deviations. There is usually room for reasonable people to disagree on both the methods by which knowledge is generated and the evidence used to substantiate it.
6. Environmental disputes often deal with systems where the whole is different from the sum of the parts. Reductionism—seeking to understand the system by looking only at the units and their relations with one another—is prone to inducing error, where problems cannot logically be traced to faults in any particular element or to the relationships between elements.

B. On Uncertainty

1. However great our information and knowledge base is, our understanding of environmental, social, and economic reality remains incomplete. We will never know everything we need to know to make perfect decisions, particularly when the decisions concern predictions of the impacts. Biological and social "uncertainty" is a fact-of-life, though it may not be at issue in every environmental conflict.[8]
2. In environmental conflicts, risks and uncertainties cannot be ignored. In cases of future consequences and impacts, research and inquiry by the parties is usually necessary and advisable, either within the conflict resolution process itself or as part of the outcome.
3. Risks and uncertainties must be clarified and understood both in lay terms and in scientific or technical terms. In general, there are three kinds of uncertainties that tend to arise in environmental cases: (a) uncertainties in which the measurements or observations are insufficient to bound explanation and interpretation; (b) uncertainties that arise because the measurements conflict; and (c) uncertainties over competing or fragmentary theoretical frameworks.[9]
4. The greater the level of scientific or technical uncertainty about significant outcomes or impacts associated with proposed actions, the more future research is warranted, either as part of the conflict resolution process or as part of the agreements that are being made. In turn, the greater the uncertainty, the more "adaptive and heuristic" the resulting agreement should be. By adaptive, we mean that an agreement should ideally seek to incorporate mechanisms that build in future information and it should be protean enough to be altered in the face of compelling new evidence.
5. Most environmental decisions have unintended consequences. For every action, law, policy, or program adopted to manage a conflict, no matter how well intended, there is a real risk of unintended consequences. They are not merely calculated risks, side effects, or trade-offs. "Revenge effects" happen because new structures, devices, and organisms react with real people in real situations in ways that cannot be foreseen.

C. On Information and Environmental Conflict Resolution

1. Conflicts over information, data, ideas, and knowledge are an inevitable and integral part of most environmental conflict resolution processes. This holds true whether the conflicts are "upstream" in the policy formation or rule making stages or "downstream" in enforcement proceedings.
2. Environmental disputes are rarely caused by scientific or technical information ***per se***. Most often, they tend to be about (a) perceived or actual competition over interests; (b) different criteria for evaluating ideas or behaviors; (c) differing goals, values and ways of life; (d) misinformation, lack of information, and differing ways of interpreting or assessing data; and/or (e) unequal control, power, and authority to distribute or enjoy resources.
3. In environmental conflicts, scientific and technical issues are embedded in a political context where value choices are at play. These underlying values are the ultimate arbiters of political decision-making, even when a plethora of scientific information is available. Substituting scientific and technical information cannot finesse value choices. However, information can more fully inform the value choices that need to be made.
4. Not every environmental case is actually science-intensive, nor is scientific and technical controversy the primary "story" in many seemingly science-intensive cases. Parties often use scientific and technological issues as a strategic or tactical "weapon".[10] Even when it is not a camouflage for other issues, parties typically bring information to the table that bolsters their position. Consensus-based environmental conflict resolution is a search for jointly usable information, which requires a joint inquiry.
5. Jointly usable information requires trust in information and the methods by which it is produced. Trust tends to diminish when parties perceive that the science has been generated from a particular point of view or with a particular outcome in mind. Conversely, trust can often be built if the questions asked and the methods employed in information gathering are jointly negotiated.
6. Scientific and technological complexity plays a role in escalatory conflict dynamics. The intricacy and technicality of some information can exacerbate a dispute by creating "mystery", by obfuscating options, or by alarming or overwhelming people with too many countervailing ideas.
7. Parties are entitled to have the lid of the "black box" of science opened for them, and illuminated, if they so choose. In joint gain proceedings, parties have a right to understand the science that informs their choices rather than being asked to trust the experts.
8. Some of the confusion and complexity of environmental conflicts are attributable to the presence of multiple parties and multiple issues and the innate intricacy of systems that have interconnections, emergent properties, and ripple effects that are not immediately apparent. Reductionist thinking ("here is the problem and these are the options") does not sufficiently take into account the potential for unintended consequences that may not be readily or easily forecast.

D. On Research and Information Gathering

1. Stakeholders should drive the technical process and determine the kinds of questions they need answered, when, and at what level of detail.
2. Overly simplified or excessively summarized information often discounts the potential impacts of the policy choices that are at stake in environmental disputes. Adequate detail is critical to assessing the strengths and weaknesses of each policy choices involved.
3. Information and research costs money. The better the research, the more it may cost. In mediated environmental conflict resolution, the rigor and depth of the scientific and technical information used in the search for consensual solutions should ideally be matched to the seriousness of the problem at hand and the significance of the risk associated with bad decisions. Scale and level should ideally be appropriate so as to avoid the costs of doing too much information gathering or the dangers of too little.
4. Either within the conflict resolution process itself, or as a product of it, more research is warranted when potential impacts are great or uncertain. This research can be part of the dispute resolution process, or can be built into an agreement. If parties choose not to have this research done, or cannot have this research done, it may be helpful to indicate an explanation to future stakeholder groups so they understand why.
5. Some disputes have urgencies that require action prior to doing all the research that would be desirable. In these instances, agreements that impact others not at the table but affected by the decision should spell out why a decision was made and offer clear assessments of the risks and benefits of doing so.
6. The process of generating, compiling, analyzing and ultimately utilizing technical information should, wherever possible, be coordinated with the stakeholder process and avoid either getting too far ahead of decision-making or being seriously delayed by it.

E. On Modeling

1. Many environmental conflicts benefit from some form of modeling in order to define problems, review impacts, or illustrate choices. The promise of models may seduce policy makers and disputants into believing that the models are infallible. However, all models have uncertainty; it is misleading to believe that a number generated by a model is a singular value that predicts a future state with absolute certainty. Stakeholders must understand (and scientists must be assisted to honestly portray) that there is a range of quantities that surround any number output from a model. This variance reflects, among other things, the assumptions of the modelers and the complexity of the natural system. Models will help differentiate answers, but will not enumerate the one true and correct answer. Models are rarely fully predictive; they are best thought of as illustrative. Models serve best when stakeholders understand that models describe ranges of options and are merely tools -- albeit sophisticated tools -- to aid in making informed choices.

2. Scientists working for opposing parties may bring different models to the table based on differing assumptions about inputs, interactions between variables, and outputs. The models then are staged to be in opposition to one another, when in reality they simply miss or talk past each other because they are, at their core, incomparable. This also occurs when scientists of different disciplines modeling the same natural system view that system from different perspectives. For example, an earth scientist analyzes global climate change through the lens of geologic time. On the other hand, an atmospheric scientist may make many detailed measurements of the present day climate and believe that such measurements are the key to predicting climatic change. Both approaches are correct. However, the results of the two models may yield different conclusions and advocates of each approach may disagree. It is the responsibility of the mediator to help parties and scientists integrate and understand each other's work and perspective, and learn how each perspective can benefit from the other.
3. Ideally, a mediator works with opposing scientists and stakeholders at the outset to have them develop a joint concept for how modeling should be accomplished. This early agreement regarding modeling must include, at a minimum, agreements regarding the question to be answered by the model, the inputs for the model, the assumptions that modify and affect the model, and the expected outputs from the model. Some scientists may also be unwilling or unable to combine their work in a single modeling effort. Cost considerations, legal mandates, pride of authorship, or simply the timing of the intervention may all prevent the joint development of models. In these circumstances, it is critical that assumptions used in all models be transparent, so that stakeholders can make their own choices on how to combine the information from opposing models in their decision-making process. This is something that a mediator or facilitator can more safely urge than an opposing party.
4. Recently, scientists and policy makers have developed methods for allowing modeling and decision-making to be more iterative, and to truly inform each other as each progresses. In disputes involving public or environmental health, scientists may be asked to apply "risk based" analysis to their modeling, carefully identifying who or what may actually be impacted under any given scenario. For resource allocation or environmental restoration issues, scientists may be asked to construct an adaptive management plan that allows policy choices to be refined as knowledge is accumulated about a given resource. Mediators should help stakeholders and the scientists serving them to determine when it is appropriate to move to a risk-based analysis or an adaptive management analysis.

F. On the Mediator's Role

1. Mediators, facilitators, and consensus-builders have their own modes of thinking and problem solving and their own vocabulary. Many third parties tend to think in terms of agreements", "decisions", and "solutions" all of which somehow imply failure when there is no tangible result to a process. Managing and sometimes limiting the inherent third-party bias for action is important. In many environmental conflicts, the right action will be no action.[11]

2. Mediators, facilitators, and others charged with consensus seeking often play a critical role in framing or re-framing the scientific and technical issues in dispute. They and the parties whom they seek to assist should be cognizant of the potential for bias that this might create.

G. On Stakeholders, Experts, and Other Third Parties

1. In environmental conflicts, parties usually come to the table with unequal scientific and technical resources. Cooperative inquiry, shared scientific and technical support, and equal access to all critical information are the highest ideals but may not always be possible. Information, technical resources, and the inquiry process should therefore ideally be explicit items of party negotiation.
2. Public agencies, community groups, and private businesses often approach the scientific aspects of their cases differently. For example, private businesses may sometimes feel compelled to put out information defensively offering only that which they believe is required by law, and no more. Community groups and environmental advocacy organizations, which often have fewer resources to work with, may feel compelled to use their information offensively and in terms that may appear strident and accusing. Government agencies charged with making decisions (particularly those involved in enforcement and compliance) are usually required by law to meet standard burdens of scientific proof. It may also be in the nature of higher intensity conflict to selectively limit the information put out and to confine it to that which bolsters one's own position. None of these dynamics are immutable and roles often shift when a government agency or community group is a proponent and private interests are the challengers, such as might happen in a standard setting or rule-making effort.
3. Classically trained theoretical scientists are less likely to offer solutions or make practical conclusions than applied scientists are. Conversely, they are more likely to identify further questions that could be explored and answered. Applied scientists are more likely to offer a range of solutions, and professions such as medicine, engineering, and the design professions are more likely to offer specific fixes.
4. Scientists with apparent disagreements among themselves often have less disagreement than parties believe they have.
5. Technical information often needs translation for lay users to be useful in dispute resolution and conflict management proceedings. In turn, stakeholders often need to be extra-diligent and study the scientific and technical information that becomes available.
6. In some instances, the role of "expert" and the role of "stakeholder" may be synonymous. Scientists become stakeholders when; for example, the site or issue is also the subject of their professional work. This is often distinct from the paid or volunteer expert who has studied a problem in question, a marshland for example, or who has general expertise on such issues and is brought in to provide scientific support for one side or to provide neutral information or assessment. Stakeholder-scientists may rightfully want and need to claim a

place at the table. In these circumstances, the impartiality of their advice may become an issue.

7. Scientific inquiry and obfuscation can be used to delay needed decisions. Parties should articulate the events, occurrences, and points in time that will trigger decisions being made even if the desired scientific information is not available.

8. Scientists often believe their work to be value-free and their methods to be observable and replicable truths. However, all science is based on assumptions. These assumptions are affected by culture, perspective, prior experience and other influences. It is particularly important in science intensive disputes for the mediator to help the scientist understand his or her role and possible role conflicts.

9. Peer review is a powerful tool for party-driven evaluations of contending scientific claims. Within the conflict resolution process, parties usually confront the following choice: (1) do we trust the work of the scientists sufficiently well that we do not need to fully understand and agree with their underlying assumptions? Or (2) do we need to understand, cross check and perhaps even affect the underlying assumptions in order to find the work of the scientists useful to the resolution of our dispute?

10. Public agencies need to rely heavily on best scientific and technical information as the settlement of disputes is pursued. Public agencies are usually the targets for legal tests of decisions. As representatives of the public interest, public agencies may have an additional incentive to ensure that consensus-seeking procedures are based on informed science to structure consensus-seeking procedures that will help formal decision-makers clarify, narrow, or bracket technical issues that may, in turn, resolve or streamline major conflicts.

V. Rules of Thumb for Mediators and Facilitators

The practice of environmental dispute resolution and consensus-building draws on theories, principles, and guidelines from different disciplines, among them, public administration, law, applied psychology, planning, industrial relations, public health, and communications. While mediation and facilitation are, at their best, rigorous and robust practices, they remain more art than science. Practice strategies tend to be tacit, reflexive, and improvisational. They are developed and refined through experience and take form in training as "rules of thumb".

The following ideas try to make some of these implicit rules explicit and are offered as supplements to the conventional methods and procedures taught in training courses or found in the literature on mediation and consensus building. They pertain exclusively to the management of scientific and technical issues.

Different agencies representing diverse disciplines often cooperate in assessing environmental impacts. In the Oasis Valley, Nevada, hydrologists drill a well to monitor potential environmental hazards from underground testing of nuclear weapons at the Nevada Test Site. The U.S. Department of Energy established an Environmental Restoration Program to acquire information about the site. The U.S. Geological Survey provides expertise and guidance on characterization of the ground-water flow system. Courtesy, U.S. Geological Survey.

None of these guidelines are infallible or applicable to every dispute. Real conflicts are chaotic and assisting disputants to thoughtfully confront the mess is an integral part of the conflict resolution process. This often requires multiple passes through the legal, social, economic, and technical issues at hand, rather than one definitive or determinative effort. In recognition of the fact that situations vary from case to case, in this section we offer suggestions with the caveat that each suggestion must be applied appropriately.

A. Substantive Knowledge

1. If sufficient experience or knowledge is lacking, do not hesitate to team up with a scientist, technical expert, or more experienced mediator. This person can advise you and serve as a sounding board in private, or can serve the group as a co-mediator in partnership with you. In either case, it is essential that the parties view this person as impartial or otherwise acceptable to the group. This is especially important if your partner will be working directly with the group. Your own generic "process" and "relationship" skills are necessary but insufficient for complex, science-based multi-party cases.
2. Immerse yourself in the issues, language, and terminology of the dispute to sharpen your own insights and ask better questions. Environmental mediation usually requires some knowledge of the institutional arrangements that parties face and at least a passing facility with the jargon of the area in dispute. Do not pretend to be an expert if you are not.
3. Allow yourself to be fully educated by the parties on technical and scientific issues. This will help you discern where their conflicts are scientific in nature and where they are not. Be a quick and savvy learner. Use your keen outsider's insights as an asset, but frequently cross check to allow parties to give you an honest assessment of when your astute naivete is help and when it is a hindrance.
4. If the parties are not professionally represented or advised, do not become "their" technical adviser. Help them confront their own needs for independent assistance with scientific matters. Your impartiality must not become an issue with the other stakeholders.
5. If you do have expertise in a given area, exercise great self-restraint in demonstrating your knowledge, suggesting solutions, or inadvertently creating the appearance that you have the answer or will somehow be arbitrating instead of mediating. If you feel compelled to offer your own insights, clearly state that you are temporarily taking on the role of a technical expert. It is best to ask the group's permission before you do so.
6. Be prepared to manage the different kinds of substantive expertise that stakeholders bring to the table. It is useful to remember that different professions are schooled to different kinds of problem solving.
7. Insure that a mixture of types of scientists appropriate to the case is involved in any given resolution process. Some professionals are primarily field and lab experts. Others have qualitative, quantitative, applied, or theoretical knowledge. In many complex, high-stakes cases, a mixture of disciplines, experience, and perspectives will be useful to the search for resolution.

B. Pre-Case Consultation

1. Work early and closely with the sponsoring or convening agency, court, or organization to identify potential scientific and technical issues. Raise good questions that spot and then probe the technical issues that may be involved. Identify the information needs of the parties up front, the kinds of data that people are relying on, and the potential data conflicts that may emerge as a case, or project unfolds.
2. Do not assume because one group has chosen you, you have been accepted by all. You will still need to gain the acceptance and confidence of all the protagonists.
3. As early as possible when an agency has asked for your assistance, form a "coordinating committee" composed of representatives of the main players or some other mechanism to ensure that stakeholders are included in the early assessment and planning.
4. Draw a picture or map of the key players, groups, and interests that, if left out of the process, might be affected, might contribute to a solution, or that could potentially sabotage a whole process. Identify their technical and scientific sophistication early. Do not presume this has been done by the sponsoring organization.
5. Find out what sources of information, what methods, and what specific scientists are most trusted by each party. Find out why.
6. Question your own assumption that scientific or technical matters are actually the question at hand. Lack of data, misinformation, or different interpretations of data are often a part of a dispute without necessarily being at the center of it.
7. Adequate funding for specific conflict resolution processes is often at issue. Often, sponsoring groups have finite resources. Make your own preliminary estimations of how resources might be most appropriately balanced among technical assessment, public involvement and skilled mediation. Be prepared to change these estimates as the case unfolds and as stakeholders come to the table and begin their advocacy.

C. Scoping and Conflict Assessment

1. Do a formal conflict assessment and incorporate scientific and technical issues into your preliminary scoping. Collect information about the technical and scientific aspects of the dispute (along with all other aspects of the conflict) through observation, secondary sources, or interviews with the parties. Raise questions that identify potential information needs, the kinds of data that stakeholders are relying on, and the potential data conflicts that are likely to emerge.
2. Get the scientists to explain how they define risks by talking about specific, levels of statistical significance and map accuracy for the particular problem or analysis.
3. Formulate good questions out of strong party-proffered assertions. Once clarified, frame (or re-frame) the technical and scientific issues in ways that pose them as problems to be

solved and questions to be answered rather than lines drawn in the sand. Phrase questions as "how" rather than "should" questions.

4. Identify the critical matters in dispute in ways that do not privilege or reify scientific and technical matters over political, social, economic, and cultural matters. There is a great temptation by mediators to try and rationalize or "scientize" conflicts when, as it turns out, they are merely tinged with technical and scientific matters and are, more fundamentally, ideological or political fights.
5. Question parties' assumptions that science-related issues (lack of data, not understanding the data, misinformation, or different interpretations of data) are actually the core of the questions at hand. Ask parties whether or not they think the principal issues are technical in nature. Often parties will say publicly that they are but then allow privately that they are not. Third parties should ideally seek to help frame issues in ways that do not privilege some issues or parties over others. It is important not to reduce or trivialize institutional racism, power relationships, risk preferences, the economic distribution of costs and benefits, or issues of management. A solely scientific focus in environmental conflicts may miss or distort the issues and the process that follows such definition.
6. In discussions with actual or potential disputants, raise questions about the kinds of information they anticipate needing and the potential impacts, risks, precautions, and benefits that are likely to emerge as a case or project proceeds.
7. Acquire a preliminary understanding of how much outside information may be available to help focus the issues, what is proprietary, and what can be freely shared with other parties.
8. As part of the assessment, or at the earliest stages possible, coach the parties on the different approaches that might be used to resolve information-intensive issues and, to the greatest extent possible, enlist them on how information will be jointly gathered and/or examined by all parties.

D. Process Design

1. Help the parties assess (and pre-negotiate) the financial and time investments that will be needed to grapple with scientific and technical information.
2. At the earliest possible opportunity, get the parties to jointly decide what is "adequate" information. Lead them through a process of thinking out what the right kind of information is and how best to bring it to the table. Ask them to identify not just the kinds of information they need, but how much of it and at what point in the process. Have them define in advance what they will do with new information, how they will (or will not) incorporate this into their decision-making process, and possibly even what kind of information would change their minds.
3. Design a mediation or collaboration strategy that anticipates and intentionally incorporates the technical and scientific issues at hand. Any strategy will usually involve choices between

joint working sessions, private caucuses, delimited position papers, oral presentations, single-text negotiating documents, or the use of outside experts.

4. Anticipate and help organize the role of partisan and outside experts, preferably before positions are fully hardened. There are many different design strategies worth considering, among them:

   a. A scientific or technical fact finding team appointed by the parties.

   b. Facilitated "science summit" in which experts (i) isolate disagreements; (ii) clarify what, for purposes of settlement, need not be contested, and (iii) search for areas of agreement that can be jointly recommended to the stakeholders.

   c. A roundtable of experts convened as an auxiliary process or "sidebar" in which scientists and technical experts have an opportunity to disagree in safety and away from lawyers, clients, and stakeholders.

   d. A moderated panel discussion in which the parties pose questions to the experts.

   e. A jointly selected third-party researcher to gather and annotate relevant peer-reviewed studies or illuminate the state of available information.

   f. A "Daubert" hearing (real or simulated) in which a third party scientist or technical expert interrogates all sides to make admissibility determinations based on scientific validity.[12]

   g. Public technical or scientific discussions or "poster sessions" to educate interested citizens on the issues, answer questions, and/or explain the state of the theory and research in a given area.

   h. Jointly created background papers to advise the parties on the issues in dispute, the respective positions, and areas potentially worth pursuing for purposes of forging a practical consensus.

   i. A fish bowl science discussion which is facilitated and observed by other scientists and the parties, the purpose of which is to arrive at a fuller understanding of the strengths and weaknesses of the scientific contentions and to educate the public about their constraints.

   j. A focused session in which scientists or technical experts are invited to draft proposed language for a single-text-negotiating document, to comment on a draft, or to help the parties as they deliberate on a draft.

5. Make advance preparations to ensure the proper level of confidentiality for technical and scientific discussions by creating submission documents or contractual agreements to participate in consensus-seeking discussions. Explicitly referring to Rule 408 of the Rules of Evidence or other forms of privilege or evidentiary exclusion may increase the willingness of parties to be open.

6. Strategize how much of the process needs to be behind closed doors versus how much needs to be in the public eye. This requires a careful and collective understanding of legal re-

quirements as well as a political balancing of public input versus private deliberation and disagreement seeking.

E. Initial Meetings

1. Insure that the conventional start-up process (ground rules, limiting topics, learning about each other's interests) is inclusive of the anticipated scientific and technical exchanges that will likely be a part of the mediation process. State the obvious: "There are policy considerations that are latent in this issue or dispute. As we negotiate, we will probably identify economic, political, social, and public policy issues within the scientific issues." Assure parties that those will be addressed (make sure to address them).
2. Explain the process. Chart a path for the joint production and analysis of technical information that leads to the development of criteria for judging options and the eventual development of the options themselves.
3. Generate multiple descriptions of the technical and scientific problems as opposed to a more inflexible single problem definition. Grappling with descriptions often will stimulate an understanding of how problems are linked with each other in the minds of both scientists and stakeholders.
4. Don't focus on data and data analysis too early. It is usually more important to understand the legal, political, social, economic and scientific context to generate a clear set of questions and to position the search for high quality information as a vehicle for informing these other kinds of judgements.

F. Structuring and Managing Discussions

1. Craft opening moves that will help the parties manage complex technical discussions. For example, ask the parties to identify when they are speaking officially or unofficially. As a collateral procedure, it is often useful to have the parties identify what the impacts of a decision or agreement might mean in their own lives versus for the community or society at large.
2. Actively coordinate the process of generating, compiling and analyzing technical information. Strategic timing can be critical. To the extent it is within the mediator's or facilitator's role, help the parties pace their technical inquiries to ensure that some parties are not left behind and to prevent the scientific process from either getting too far ahead of legal issues or slowing down the problem solving process.
3. Discuss the parties' various perceptions and definitions of "risk" and "precaution". Find out how their ideas apply to the case. Definitions will vary among stakeholders. Discuss the nuances so that the many meanings of both terms are understood.
4. Use data as a discussion point rather than assuming it will inherently lead to an answer.

5. In the face of unequal access to scientific and technical expertise, discourage the use of overly sophisticated presentations by one side. Power-Point presentations, slick graphs and charts, and complex maps can create an overwhelming sense that certain solutions are predestined. Instead, or in addition, use jointly constructed decision trees, flow charts, cognitive maps, and other visual tools to help display the thinking of the parties as regards content and process.
6. Encourage lay stakeholders to rely on the persuasiveness of evidence, not the "weightiness" of the expert. As in trial, creative uses of statistics presented by skilled experts can overshadow the fundamentals of good scientific method.

G. Working with Experts

1. If it is useful, assist stakeholders in clarifying the kinds of scientific and technical activities that may prove pertinent to a resolution. Usually, these will fall into one or more of several categories:
    a. Description: Generating accurate inventories, maps of habitats and natural features, critical areas, descriptions of natural processes, etc.
    b. Causal Analysis/Diagnosis: Explicating the causes and consequences of public health or ecological disturbances e.g. what's causing reef bleaching, forest die-offs, the bad taste in the water, etc.
    c. Prediction and Modeling: Identifying probable ecological effects of specific land, water, or public health decisions, e.g. dredging 300, 500, or 900 yards away from a reef; in-stream flow levels under different diversion scenarios, etc.
    d. Prescriptive Design: Providing advice in formulating performance standards, emission standards, etc.
    e. Valuing: placing economic ecological or economic values on resources or impacts, e.g., variable abilities to pay, shadow prices, internalized vs. externalized costs, "pristine" vs. "disturbed" habitats, etc.
2. Include social scientists. While biophysical and life science experts tend to be more obviously relevant to environmental issues, social scientists will often bring rigor to the analysis of cultural and social impacts and to some of the more qualitative and subjective aspects of decision-making.
3. Build bridges between scientists and non-scientists by helping each to understand the other's perspectives, values, and ways of knowing. Experts and lay people often talk past each other. Choreograph the proceedings and schedule time to help stakeholders understand the orientation of scientists and scientists to understand how important other ways of valuing, knowing, and deciding are.

4. When scientists present models, maps or graphs, be sure to take the time to explicitly present and clarify the assumptions behind the data and the ways to understand or appreciate the maps or the models.
5. Technical experts and scientists often become infatuated with their own curiosities and with issues in their own fields of expertise. Rope-in the science so that the questions under discussion and the data and information being examined are germane to the issues at hand. Frequently, this requires that the mediator have scientists conduct a dry run of their presentation. During this dry run, continually (and ruthlessly) ask the scientist to illuminate the relevance of what they are asserting to the decisions that are in front of the group.
6. Urge parties to bring forward studies and data that have been peer reviewed. Lack of peer review does not inherently disqualify information from being useful. However, the peer review process gives weight and credibility to scientific and technical information in the face of contending claims.
7. Technical and scientific presentations often need explanation and translation. Encourage scientists to use plain language and good visuals (pictures, photos, maps, and cartoons) so that participants can understand the issues, the data, and the uncertainties.[13]
8. Assist dueling experts by bringing in an acceptable third-party scientist. Experts are often amenable to discussing their differences with a respected colleague in their field. To help the parties choose this person, ask first about the criteria for selection, then on prospective names.
9. When dueling parties (who themselves may or may not be scientists) utilize an adjunctive or "sidebar" meeting process, create specific terms of reference for the working group. Help stakeholders focus their questions. Write them down and reach explicit consensus on the wording. Avoid threshold questions ("Should we?"). Instead ask questions to elicit responses that allow finer judgements to be made, for example, "Under what circumstances might we?" In some cases, stakeholders may be willing to agree in advance to abide by the answers provided by the sidebar.
10. In most environmental conflicts, the mediator or facilitator needs to act as an "agent of reality" and pose reality-testing questions that lead parties to question whether, in fact, their positions are tenable and can be sustained. For example: "The judge has said the present situation is unacceptable. It is incumbent on everyone to reexamine his or her point of view since it seems implausible that one side's point of view will prevail and everyone else's will not." In some cases, it is useful for the mediator to orchestrate an examination of the expert(s) in front of the parties to help stakeholders assess the expert's trial potential.
11. Be mindful that scientists are people with a range of personal skills and styles and their own political preferences. No scientist is perfectly neutral. Allow parties to confront the assumptions, proclivities, and predilections of their own and each other's experts. Mediators and facilitators can help with this by also asking each expert to state what his or her understandings of the pertinent risks, benefits, and cautions are, how those matters can be quantitatively and qualitatively described, and how their definitions apply to the facts at hand.

12. Be prepared to illuminate (or have someone else illuminate) the base assumptions behind any scientific assertion, especially if there is a conflict over it. Take care to preface this information in ways that help the parties understand that differences in assumptions are rarely the result of malice or ignorance but, more often, legitimate differences in professional approach, scientific judgment, previous experiences, and party interests.

H. Negotiation and Problem Solving

1. Many disputants in environmental cases are repeat players and sophisticated in negotiation and settlement. Let the "natural mediators" among the stakeholders do what they do best. Have the good sense to get out of their way.
2. Privately explore the best and worst alternatives to a negotiated agreement (BATNA) to understand how each party proposes to handle scientific uncertainties if there is no agreement.
3. As part of a negotiation, it may be useful to secure a commitment from the stakeholders to do a representative test or data collection. Have them decide in advance what decision they will collectively make under different outcomes of the test. Then have them agree on the method to be used to conduct the test or generate the data. The data collected or experiment conducted should provide enough information for the parties to make a decision or justify their joint decision to others.
4. Scientists, engineers, and technical experts often have psychological barriers to making trade-offs. If they are uncomfortable with the bargaining process, do not ask them to barter. Instead, ask them to articulate a rational framework for the decisions or options that are under consideration. Appeal to their expertise and attempt to validate their differing conceptual frameworks. Help them understand that there are alternative ways of approaching complex policy problems and that to reach resolution it is often possible to balance several competing frameworks. As with other kinds of negotiations, explore bundles of gives and takes and suggest that the scientists think in terms of agreeing on probable ranges rather than trying to find a perfect number.
5. Help the scientists and technical people, along with all other parties, grapple with the idea that compromise solutions are not inherently "dirty."
6. Stakeholders may want to abstractly argue about the "Precautionary Principle" versus "Reasonable Risk". At core, this debate is ideological and too broad to resolve in the context of any given case. In a mediated or facilitated process, parse this debate into explicit pieces that allow sides to make trade-offs according to their tolerances for risk.
7. Expressly discourage traditional offer/counter-offer negotiation styles that imply "right" and "wrong" judgments. When complex technological questions are at issue, parties will often retreat into what they believe is the right answer that cannot be compromised. Frame the negotiating discussion as not about what is right, but rather how everyone can find a livable solution.

8. Modeling is a routine procedure in understanding the magnitude and consequences of variable resources. It is often also a methodological issue in environmental disputes. However, modeling, whether it be of a drainage system, a forest regeneration plan, or an oil spill, also presents an opportunity to bring the parties closer together in the search for wise answers. Have the parties negotiate the critical assumptions that will be used in either a single model or in competitive models. Stress the need for transparency of assumptions, the tentativeness of the model(s), and the limitations and uncertainties of the modeling being done. Make sure the models logically track back to the fact patterns at hand.

I. Agreement-Making and Implementation

1. Help parties understand when they have sufficient agreement on technical issues to go ahead and negotiate solutions. Often, scientists want to keep fighting until they get complete agreement on precise numbers. However, the accuracy that is necessary to develop a solution may not be as extreme as scientists would prefer. For instance, it may not be necessary for all parties to agree on the exact level of pollution in order to recommend a remediation strategy which handles both the high and low estimates of the various parties and achieves regulatory criteria.
2. Assist the parties in making as explicit as possible the key scientific assumptions on which the agreement is based. Explore with them what mechanisms they will put in place to monitor those assumptions what they will do if those assumptions turn out to be different or untrue.
3. Promote dynamic, flexible, and adaptive agreements that balance reasonable stability (which is usually needed for business stability) with flexibility and performance-based adaptability (which are needed for higher levels of environmental assurance). While it may not always be possible, try to help the parties craft an agreement that allows for change so that if they are wrong about the science, they can revisit and re-negotiate the issues. This kind of agreement-making is intrinsically difficult, especially in public health issues. Defendants and respondents usually require closure and release so that they do not have on-going liability or adverse publicity. Plaintiffs and complainants are often unwilling to concede closure because of scientific uncertainties. Options to consider might include:

    a. A contingent agreement for additional rounds of negotiation based on further research and testing.

    b. The capping of future liabilities by private parties through the purchase of an insurance policy or bond to cover unknown exigencies. For example, an insurance policy could be made to cover a capped high and low of the disputed potential cleanup costs for an underground cleanup.

    c. An agreement that will be revisited within a certain period of time.

4. Help parties understand that all scientific decisions are provisional despite the seeming finality of legal, administrative, and political decision-making. In essence, it may be important to help parties understand that they are fashioning a resolution that is "temporary" until such time as future scientific evidence can better inform the decision.
5. It may prove critical for the mediator to bluntly confront the parties to make their best case/worst case arguments to the other stakeholders. The mediator may need to state: "We are not going to settle this unless you can convince the other side to agree. Let's chart out everyone's best facts and arguments."
6. Help the scientists maintain face at the conclusion of an agreement that still poses great uncertainty.
7. Include the scientists when you celebrate closure.

VI. Navigating the Rocks on the Road: Practice Tips

Section III listed 23 fact-patterns that mediators and facilitators sometimes encounter. While there are many possible responses to these challenges, we asked a number of experienced practitioners to suggest what tools, techniques, or tactics they might use in each situation.

1. **Multiple Disciplines**. The Problem: Environmental groups seek to prevent an agricultural operation from withdrawing additional water from an aquifer. Geologists and hydrologists find the water is available. Ecologists and wildlife biologists show that withdrawal will harm nearby stream biota. Sociologists and economists conclude that new farms will revitalize an economically depressed area.

   Gail Bingham, RESOLVE, Inc. Washington, D.C.: Information from different disciplines has the potential to create confusion and, thus, magnify environmental disputes. However, solutions also need those very differences. To increase the likelihood of benefiting from multiple disciplines, I would clarify as early as possible what decision the parties are trying to make. This has two benefits for parties' criteria for determining what are decision-relevant information and a focus for integrating disparate information. I recognize that scientists (and people generally) often ask different questions from their different perspectives and/or disciplines. This is strength in problem solving if the interaction is explicit, but it creates the potential for discord if it isn't.

   In this and many similar situations, I would encourage the parties to have an explicit conversation about what question(s) they are trying to answer. In this way, they can be proactive in obtaining decision-relevant information, avoiding gathering information that appears to diverge because it actually answers different questions.

   This approach also will provide scientists a concrete focus for integrating the different information from their different disciplines. In this case, the geologists and hydrologists probably are asking whether water is available, whereas the biologists are asking what the harm will be from withdrawing water. Both are likely to be right, but neither may be answering the question that is most helpful to the parties.

   If I bring the tools of interest-based negotiation to bear (specifically reframing the question to be as inclusive of different interests as possible), the parties may actually be able to agree that the questions are as follows: How much water can be withdrawn? From where? And under what conditions without harming nearby stream biota?

   Many times, once the question is framed to be as sensitive to as many interests as possible, the strengths of different disciplines can be integrated toward finding creative, interest-based solutions.

   Greg Bourne, Cave Creek, Arizona: On the surface, it seems the adage "the more information the better" applies to solving tough scientific or technical problems. But this is not always the case. This example highlights a missing link, which limits the value of information: values.

   Values ultimately will provide the basis for decision-making. If they are ignored or not

properly accounted for, the appropriate context for analyzing and using the information is lacking. In this case, the most effective use of the information is to support the discussion and prioritization of values.

I would use available information to clarify the resources under greatest pressure, most highly prized, most sensitive to impact, etc., as an essential step toward sound decision-making. Where competing uses for resources is the issue, I would try, through strategic planning, goal setting, and techniques such as values mapping, to prioritize values and help people understand potential resource-management tradeoffs.

I would use tools such as geographic information systems and visual overlays to help the parties make sense of diverse information and apply it in a manner most helpful for prioritizing values. Then it will be clearer about which information is most useful in decision-making.

Tom Fee, The Agreement Zone, Freehold, New Jersey: My objective would be to try to help the participants understand and assess their perceptions about competing world views, the clash of data, rival reports and enemy evidence, and what William James called "mind created manacles".

Participants come from very different backgrounds, education, training, and experience, even when they are all experts on the same subject. I would create opportunities for them to see the varying perspectives of their colleagues.

If the participants are amenable, we would work to design an approach that will invite them to look at the world from different points of view, rather than from the perspective they have or had when they came to the negotiation. This approach would invite the group to try on different lenses and look from different angles of observation.

2. **Access to Data.** The Problem: Competing recreational users (hikers, horse riders, and bicycle riders) are engaged in a rule-making dispute over management practices in a multi-purpose wilderness area. Although the stakeholders are bright, intelligent people, they are highly positioned and unaccustomed to these kinds of conflicts.

David Keller, U.S. Institute for Environmental Conflict Resolution, San Diego, California: Categories of uses need to be critically evaluated by the group to determine if user categories may need to be added or subdivided. For example, "hikers" might have to be divided into day hikers and backpackers, and so on. The mediator will then need to help the parties ferret out all sources of information relevant to the various uses and ensure that the data is compiled in a format that is understandable and helpful.

I would look to the managing government agency as a likely source of quantitative data that could include, for example, what damage there has been to the environment, whether it is repairable (sustainable) under existing guidelines, and the costs of repair and maintenance.

All of this information would ideally be graphically displayed on a grid so that the different recreational users can immediately see the ecological and monetary cost of their own

particular activity in comparison to others. Data from other comparable wilderness areas might also be used to get cost comparisons.

Lucy Moore, Lucy Moore Associates, Albuquerque, New Mexico: Here are some options I might pursue.

I could find mentors for my group. I would look for a comparable situation elsewhere, hopefully not far away. I would invite a couple of those participants (from the process to revise the forest management plan, or create open space for a neighboring town, or whatever) to talk to the group. I would ask them to walk through their process and focus on the points where information needs were identified and how the answers were secured.

Hopefully, they will have a good outcome that highlights the kind of data that is useful in helping craft a solution. I could find a professor who might come and outline for the group the kind of data they might need, and give them generic ideas about where to find it.

I could hold a "Let's Look at the Landscape" session, in which I would bring in experts, scientists, policy people, tribal leaders, and others to educate the group on the ecology, law, institutional authorities, and cultures which make up the proposed wilderness landscape. I would suggest to the group that although they are of course educated, highly intelligent, committed, and motivated, there are facts about the area we will negotiating that are important for us to understand together.

We need a common language and platform from which to work. I would encourage questions to identify additional data needs, and get direction from the presenters about how to get that data. Hopefully, I would end the session with a common understanding of the landscape and a list of questions and sources for answers that will spur the group to learn more.

I could arrange a group field trip to the area in question. I would let each interest take a turn in leading the trip, through a section important to them. I would encourage other interests to ask probing questions: Will your bicycles cause erosion if you ride down this hill in the mud? I would keep careful track of the questions and lack of answers, and save part of the day to sort out the data needs together.

I have found field trips to be great equalizers when there is a disparity of interests, or when there are some highly trained technical people and some uneducated community members. For example, subsistence farming community members took EPA and Colorado State technical people on a field trip to the headwaters of the Alamosa River to look at contamination from an abandoned gold mine. Because the local people were hosting the field trip, there was a shifting of the power balance that had not occurred before. The locals knew the roads better, dressed more appropriately, had stories to tell, and showed a sense of pride and ownership in the landscape.

For all their expertise in geology, hydrology, and chemistry, the technicians were out of place and in a sense dependent on their hosts. The field trip also gave validity to the

anecdotal kind of data, which the locals had been trying to push on the scientists for months: "I caught fish in the Alamosa River when I was a kid in the '40s. That proves there were fish in there then."

In the field, that anecdotal data seemed to have more credibility with the scientists. You could see them looking at that spot, just above the fork, where the big trout was caught.

3. **Adequacy of Existing Data**. The Problem: A community group and a resort developer are in conflict over short- and long-term traffic impacts of a new golf course. The developer believes enough studies have been done. Community believes more are required.

   Mary Margaret Golten, CDR Associates, Boulder, Colorado: The first thing I'd do is question if these data are really necessary or if the group is obsessing about this as a form of avoidance. If the traffic questions were answered to the satisfaction of all parties, would that solve the problem or are there other value differences?

   Recently I had two clients arguing fiercely about facts. We could have worked hard to clarify, get a third party view on the facts, work on where to agree to disagree, etc. However, I asked one side if the data question were resolved, would the dispute would be over? They gave a resounding "No."

   The problem was really about relationships and a total breakdown of trust. If, however, there is really technical information missing, the second big issue is where to find resources to do additional studies.

   My "interest analysis" with the developer will go something like this: If you were in a similar position as the community and you didn't agree with or trust the research done by your "opponent," would you ever give up the dispute? Is it important for you, the developer, to get the community's agreement on this issue? Are you comfortable with your data? What would you be willing to do to help the other side get more comfortable? Would you be willing to assist them in getting a Technical Assistance Grant? Form a joint committee with them to look carefully at your studies? Provide funds for them to do their own study?

   As the focus on the studies progresses, it would be crucial to avoid escalating the "data wars". I'd be careful to get agreement on exactly how the question to be research is framed, as well as what the parameters of the studies should be.

   Martha C. Bean, Mediator, Seattle, Washington: When parties challenge the adequacy of data, it can be a stalling tactic. To say "we don't know enough to make that decision" is a dandy way to avoid making a decision at all.

   In time-critical negotiations, where one party would benefit from a delay, it is my responsibility as the mediator to ascertain (most likely in caucus) if the request for more information is really a play for more time.

   Another technique I have used is to ask again, first in caucus: "What decisions can you make with the information you have at hand?" "What decisions do you think the other parties would be willing to make with the information we have on the table now?"

Comparing these answers among caucuses can wholly re-define the critical path for decision making, often to the surprise (and sometimes to the relief) of the parties.

I might also ask a "do no harm" question: "Are there any decisions you might make now, with the information you have now, that might eclipse other critical decisions later or prevent something beneficial from happening in the future?"

In the Northwest, people are becoming accustomed to using an "adaptive management" approach to natural resources decision making. Parties jointly design a decision tree that allows them to move forward and take action, but requires re-assessment and revision at specific future points in time. The checkpoints are defined either by time, or by results from monitoring.

An adaptive management approach has the dual advantage of allowing action, while retaining the ability of the parties to make course corrections as experience is gained and as more data become available. It would only be ethical for me to encourage such an approach if all parties clearly understood the potential consequences of moving forward without full and complete information. For instance, most parties in the Northwest believe adaptive management is well suited to salmon recovery efforts because to do nothing is means almost certain doom to endangered salmon runs.

Development, on the other hand, is often a different story. Imagine a controversy over the re-zoning of a piece of open space so that low-income housing can be built. If the housing were built, it would mean permanent loss of that open space. If the housing is not built, it could mean permanent loss of the potential for low income housing in that area.

There may not be an "adaptive" solution; it is an all or nothing choice. Waiting for all the right information may be essential in such a case.

4. **Unclear Significance**. The Problem: Proponents and opponents use computer-generated pictures to simulate the proposed visual and aesthetic impacts of a series of micro-wave relay towers on a ridge over a park and residential community. People are intrigued with the pictures but some participants are not convinced that the simulations give them the information they need to make decisions.

   Daniel Bowling, Society of Professionals in Dispute Resolution, Washington, D.C: I would initially work with the parties to help them tell their story of the dispute. I would ask them to focus their conversation on the fundamental elements of the dispute to illuminate in what arena the dispute lives — be that economic, relational, legal, scientific, informational, power, etc.

   The focus of this initial conversation would be on building an appropriate level of relationship among the parties to support a deeper exploration of the nature of the conflict. Given that clear scientific and technical information does not exist, greater trust and relationship within the group is necessary.

   Next, I would focus on identifying the fundamental wisdom in the group regarding the

dispute that is not based on scientific or technical information. I do not mean the critical issues in dispute. I mean the non-scientific and non-technical wisdom among the parties regarding how to resolve the dispute.

This portion of my facilitation would examine what potential solutions exist that do not depend on the unclear information. In order to draw out this wisdom, I would first focus on the criteria on which an ideal solution should be based and then on the options for resolution.

Next, I would work with the scientific and technical advisers and the parties to determine whether there is some level of the issues at which there is greater scientific certainty. I would re-examine the unclear scientific and technical information to determine whether there are some of the criteria that support or advance or inform any of the potential resolutions. I would assist the parties in determining whether the unclear information becomes clearer at some level of the conversation or at some level of potential resolution.

Any time the group got stuck, I would create a separate "fish bowl" dialogue among the scientific and technical advisers to discuss and analyze the data, illuminating for the parties the nature of the information, the range of differences among the advisers, and the basis of those differences. I would work to focus this dialogue on the criteria and options.

Finally, I would return the focus again to the fundamental wisdom of the group as informed by this process, assuring the group that the ultimate resolution was within that wisdom and not hidden in the unclear scientific and technical information.

Bob Barrett, Collaborative Decisions, Menlo Park, California: The parties are probably proceeding from very different sets of assumptions and value systems and do not understand nor appreciate those of the other parties.

My approach would be, first, to encourage the parties to tell their stories about the place of concern and the need for microwave relay towers. I would encourage residents to talk about living in the community and their use of the park and the meanings that those places have for them. I would encourage the proponents to describe the benefits that would flow from the project and the need for the microwave towers as an integral part of it.

If discussion alone did not lead to breakthroughs in empathy and mutual understanding, I would try other ideas. For example: (a) ask the parties to construct an audio-visual presentation, perhaps on flip charts, with photographs, or on computer screens, that would convey what the towers would mean for the community and for the proponents; (b) make available a small film or video crew to be directed by the parties in constructing a short film in which the computer-generated pictures can be presented in the context of the project's needs and the community's values; or (c) assuming the parties were comfortable enough with each other to permit taking some personal risks, ask the parties to construct a short dramatization or skit that they could play as a group, using the computer-generated pictures as a theme.

My expectation would be that one of these methods would succeed in achieving a level of trust and understanding. This would permit the parties to talk directly about whether the computer-generated pictures, or some other means, would best permit them to communicate the deeper meaning of the project to each other.

5. **Restricted Data.** The Problem: Water well drilling permits must be issued by a certain date, or the project proponent will lose the opportunity to proceed. A government agency, different from the one issuing the permit, is unable to release its latest study of chloride buildup because it has not been approved for release. Simultaneously, the drilling company is fearful of disclosing trade secrets that might give its competitors an edge.

   Martha Bean, Mediator, Seattle, Washington: As a first step, I would probe the time-sensitive nature of the permit process. Is there really no recourse for the project proponent if the permits are not issued by a certain date? Is it weather conditions, financing agreements, or commitments made to investors or other agencies that drive the time sensitive nature of the permits?

   I would explore with that party what alter-natives they see – if any – for extending the issuance date, and the consequences of either doing or not doing so. Next, I would work with the two agencies (the permitting authority and the research agency) to determine if there are reasonable ways to use existing data to make rational decisions. If there are, I would fully document how this can be done, noting assumptions made, risks taken, and remedies that can be implemented if the decision based on older data turns out to be wrong.

   As a last step, I would work with the drilling company to better understand what it is they do not wish to disclose and get them thinking creatively about mechanisms for demonstrating their competence to the permitting agency without disclosing this information.

   There may be performance standards that can be used. For example, rather than saying, "We will use this technology," they could say, "We will produce less than X percent effluent, to be measured and recorded hourly." These alternatives would then be negotiated with the permitting agency. The permitting agency may be loath to set precedents they do not wish to make available for others in the future. Agreement language may need to include descriptions of why this is a special case.

   Tim Mealey, Meridian, Washington, D.C.: First, I would explore the nature and degree of confidentiality and/or proprietariness of the data. In the example posed, I would try to find out whether the government agency that claims it is unable to release the latest study on chloride buildup, because it has not yet been approved for release, can nevertheless release a draft which would be properly caveat.

   Often government officials believe they are unable to release draft documents when in fact they can. Furthermore, more often than not, they may be required to make documents publicly available when they sometimes would rather not. So, I would not take no for answer to begin with.

If this did not succeed, I would try to find a way to share the information that is contained in the document and would be critical to resolving the decision, without necessarily releasing the document. Which is another way of not taking "No" for an answer.

Finally, if it really were not possible to release the government report, I would determine what date they do intend to release the report. Then I would determine whether there were other issues that the parties could effectively address while awaiting the release of the report, find mechanisms by which the agency could be held accountable to the release date, and return to the issues associated with the report when it has been issued.

With regard to the proprietary data, once again I would probe as to the nature of the information to make sure there really are "trade secrets" that needed to be protected, or whether the information really is critical to resolving the dispute. Assuming the information is proprietary and critical to resolving the dispute, I would explore ways in which the information can be filtered and utilized through a third party. The third party could be either me as mediator/facilitator, or some other trusted expert who would agree to abide by confidentiality agreements to protect the proprietary nature of the information.

6. **Politicized Information.** The Problem: Proponents and opponents are engaged in a dispute over improvements to a highway that is statistically safe but perceived to be dangerous. Numbers suggest that although the highway has a high proportion of dramatic accidents, the overall accident rate is low. Citizen groups have taken out ads calling for expensive improvements. The city has appeared on talk shows arguing that the proposed improvements are expensive and would not make a difference.

   Peter Adler, The Accord Group, Honolulu, Hawaii: Once a mediated process has been established and the parties convened, I would work with the stakeholders to isolate the core technical questions that need to be answered.

   The challenge here will probably involve ventilating some of the initial emotion and drama, narrowing the technical questions, and reaching agreement on what constitutes "salient" information. I think a well-constituted technical team might productively clarify and decode the accident rates.

   Once the data has been explicated and interpreted, the group can begin to tackle the political problems involved in various possible solutions. I may do a lot of that in private. If there are public meetings that need to be planned, I will do a lot of choreography (poster sessions, Q &A with the experts, brief background papers) aimed primarily at enhancing the public's understanding of the issues, the data, and the options.

   Bob Barrett, Collaborative Decisions, Menlo Park, California: The problem here appears to be that there is no forum for collaborative problem solving, only the political process. The need is to generate the political will and vision in sufficient numbers of people to permit a collaborative process to begin and be sustained over the time required for it to have a chance of success.

   One approach to this would be to identify a neutral, respected agency or organization,

perhaps a community foundation or a university center or "good government" group, and suggest that they convene an initial meeting to address the situation on this particular highway segment. At this meeting the city's representatives might be asked to make a presentation about the evidence supporting the conclusion that the highway meets current safety standards. Also on the agenda would be representatives of the citizens groups who believe safety improvements are warranted.

It might be possible to stage a game or simulation focusing on the multiple perceptions of the safety of this highway or perhaps focused more broadly on how best can safety on our community's highways be enhanced. The game/simulation would need to be prepared by the convening organization and could be played several times with different groups of role players from the community. Parties to the political dispute might be asked to play, first, one set of roles and, later, another set of roles, so they have the experience of seeing the multiple dimensions of the problem.

Based on this experience, it may be possible to suggest a collaborative process that would take the problem out of the realm of the hypothetical and into a real search for a lasting solution to the problems that have been identified and acknowledged by both sides.

Suzanne Orenstein, Mediator, Prides Crossing, Massachusetts: In a situation where the scientific information has become politicized, my first step is to find a way to acknowledge that the information sources for discussing the problem are not sufficient for everyone to trust them. Naming the situation and then discussing how to improve the information base can be a powerful mechanism for beginning to problem solve as a group.

If some or all parties were using the press as their primary method of engagement with each other and the public, I would work with the parties to determine how this strategy fit with their desire for a settlement. Often, parties go to the press independently because they believe that the press provides a valuable forum where they can demonstrate strength and acquire leverage.

If the parties are truly seeking settlement, I have at times suggested that the parties depoliticize the debate by working jointly with the press, describing their differences (including their scientific differences), and correcting any misapprehensions about the dispute or the dialog. This strategy allows them to provide explanations to their constituencies for some of the decisions they may make in the process of settlement.

It is standard practice for groups to devise a protocol for addressing press contacts in order to avoid the politicization of information that can occur when the negotiation is conducted in the press. Sometimes a group will ask me to play the role of liaison with the press; other groups appoint a committee or executive group to do this.

My approach with parties was to help them see that the press could be helpful to them in promoting public understanding of the differences of opinion, many of which were technical, which would need to be addressed in any eventual settlement.

7. **Lack of Expertise.** The Problem: Various private and civic sector organizations come together to resolve opposing positions about a huge public expenditure over secondary and tertiary sewage treatment. They are confounded by complex and often conflicting toxicological, engineering, and ecological studies.

   Christine Carlson, Policy Consensus Initiative, Santa Fe, New Mexico: As part of the conflict assessment or when the situation arises, I would ask the respective organizations for the names of experts whom they rely on for information. I would work with the group to formulate and refine a series of questions they want to pose to the experts.

   Then I would call the experts to screen them and to learn what they know about the toxicological studies in question and ask them how they would respond to some of the questions. I would be listening for how effectively and objectively they explain the information. I would ask them about the conflicting information. I would also ask them for names of experts who hold views different from theirs that they respect and can communicate with effectively.

   Based on what I learn I would report back to the group and suggest alternatives for how they could proceed. Alternatives could include: (a) invite a select panel of experts who hold different views, but who have the ability to communicate effectively with each other, to meet with the group to explain the studies and answer the questions; (b) invite a single, select expert to explain the studies, conflicts, and reasons for the conflicts from the different perspectives and answer the questions; or (c) invite a select panel to answer the group's questions in writing, and then, based on the answers, decide whether to bring a panel or individual expert before the group to pursue the discussion.

   Tom Fee, The Agreement Zone, Freehold, New Jersey: I would make several suggestions. Especially when the issues in controversy are place-based, I would propose field trips and site visits.

   If participants representing different interests or areas of knowledge and experience entangle the conflict in competing interpretations, I would propose moving the locations of the meetings. Shifting the meeting sites can help participants understand the place where the others come from—for example, meet at their offices, laboratories, factories, or community halls. The act of going to the place where your perceived adversaries work or live is a terrific way to get participants to listen and observe as allies and comprehend another way of knowing and seeing the issues.

   Meetings can begin with tours and information sharing. The whole group thus shares the experience of being together in different settings while focusing on mutual understanding of the underlying interests.

8. **Inconclusive Data**. The Problem: A large oil company is proposing to build a lengthy oil transmission line. They have done several studies, each time using slightly different assumptions and criteria in order to find the best route. Based on these studies, and believing they have been responsive to various public interests, they re-routed their line several times. Opponents believe the line and its construction will contribute to fragmented habitats, non-point source pollution, and the disruption of several very small and fragile wetlands.

Biologists use tracking data to assess oil industry impacts on breeding populations. On sea ice north of Prudhoe Bay, Alaska, some 100 miles offshore, wildlife veterinarian Daniel Mulcahy fits a tranquilized male polar bear with a satellite transmitter. Data from such radio signals helps to determine population numbers and movements. Photo courtesy of Daniel M. Mulcahy, Ph.D., D.V.M.

Peter S. Adler, The Accord Group, Honolulu, Hawaii: Presuming we have the right representation at the table, I want to try and help the parties organize a process in which they jointly set forth the explicit scientific criteria by which they are evaluating routing options. I want this to be a group exercise in which they actually score alternatives against each other. Essentially, it's going to be a big criteria/option matrix.

There is a lot of preliminary conversation to be had about the nature of the problem and the meaning and impact of the dispute in each person's life. However, the precursor to decision-making is arraying criteria and potential solutions. To do this, the stakeholders must first examine the three issues (habitat, NPS pollution, and small wetlands) in depth and one-by-one.

I will ultimately encourage them to bring their best evidence to the table and discuss the comparative value of the studies they are relying on (i.e., published, unpublished, peer-reviewed, more analogous or less analogous facts, etc.). Then, we'll do an actual scoring. The rankings are going to be a backdrop and starting point for the much harder political discussion that will ensue.

Elaine Hallmark, Hallmark Pacific Group, Portland, Oregon: In this situation, I have used specific dialogue and reality testing. The steps and goals of the dialogue are generally as follows.

First, acknowledge the current status. The data is inconclusive; therefore, the decision is not obvious from the data. If parties cannot accept this or do not acknowledge it, it may be difficult to move forward. Sometimes a panel of technical experts jointly presenting and being interviewed by the parties will help to gain acceptance of the reality.

Second, review the BATNAs. Are the parties better off agreeing on how to proceed? If one party believes the lack of data is sufficient to stop the project legally (or get their way in a different type of dispute), they will likely not proceed. However, if they have seen that the data is inconclusive and will not likely prevent the project (or persuade a decision-maker/court to do what they want), they will likely be willing to proceed.

Once parties believe that they need to reach an agreement in spite of the inconclusive data, they can focus on the best next step and on future adjustments that can be made. I would help them brainstorm ways that the project can go forward with the least possibility of harm, while also gathering data about the effects. I would also encourage them to look for ways the parties can work together to monitor and get the information needed to evaluate cumulative effects. Some effective approaches have been to jointly apply for grants to study the future effects, or set up some other funding mechanism for the future monitoring and research.

Both parties must assess the risk they see to their own interest and the other's interests. They need to find an agreed-upon path forward that will minimize the risks to the interests of both, and provide a mechanism for future correction based on the "feedback" data.

9. **Purchased Information**. The Problem: Several large manufacturing companies have been sued over the contamination of a river. The government agencies and citizen groups that are involved refuse to rely on the studies that the companies are using but have no funds to do their own.

In Prince William Sound, Alaska, this male surf scoter is instrumented with a satellite transmitter. Prior to the Exxon* Valdez *oil spill of 1989, biologists extensively studied the region's wildlife. Therefore, scientists have benchmarks against which to compare current data, to help determine how the spill impacted breeding populations. Courtesy, D.M. Mulcahy.

Lucy Moore, Lucy Moore Associates, Albuquerque, New Mexico: Here are some of the things I would consider.

Peer Review: Hire an expert who is trusted by everyone to review the data for the group. It might also work to let those without the data hire the peer reviewer. This will cost some money, but nothing compared to doing additional studies.

Public Debate: Bring in the leading expert in the country on this particular kind of contamination, and hold a public forum, where s/he can grill the other experts who have prepared the studies. Just give in, and let it be as adversarial as everyone wants. It will be of limited duration (one evening), and will at least provide some satisfaction on the part of the government and citizen groups. They will have the chance to see their big gun go after those with all the data, the way they wish they could do themselves. Again,

it will cost something, but not as much as doing more studies.

I have done this, and the company defending their studies paid for it. It was an issue of EMFs from electric transmission lines, and the debate made everyone realize that there was going to be no answer to the big question about health risks from EMFs. Surprisingly the group settled down after that, each with a sense of smugness (well, I guess we showed them!), and worked out guidelines for transmission lines through the city.

Put Data in Perspective: At some point, it can be helpful to put the role of data in perspective. The data-less side may not want to hear that data isn't all that important. But it still needs to be raised.

"What difference would it make if you had a million dollars and bought a big, fat study for yourself?" "Do you think the company would believe it if it differed from theirs?" "We need to get this river cleaned up as quickly as possible. Do we want to get into data wars?" "Let's try to pick a goal for clean up that is the best we can do for now, and maybe we can build in some parameters that will allow us to adjust later, as more data comes in."

Greg Sobel, Environmental Mediation Survey, Sudbury, Massachusetts: Contrary to convention, it is possible for scientists paid entirely by "one side" to provide objective analysis that is trusted by stakeholders and is well-grounded scientifically. This is true even when the parties disagree vociferously about the science-based decisions to be made and notwithstanding deep-seated distrust.

This is exactly what occurred at the Massachusetts Military Reservation where branches of the military are cleaning up over a dozen plumes of contaminants moving through the sole source aquifer for upper Cape Cod. In 1996, the cleanup program screeched to a halt when a particular pump and treat strategy for handling these plumes was rejected by regulators and citizens as unworkable, ill-conceived and, from both a scientific and social standpoint, fatally flawed.

As the lead facilitator at the site, I proposed the creation of a multi-disciplinary, inter-agency team of scientists to critique the failed plan and develop the framework for a new cleanup plan. The new plan would address the failings of the proposed approach and provide a credible, scientifically sound and politically realistic way forward. This Technical Review and Evaluation Team (TRET) reached those objectives and continues to meet periodically to advise the agencies leading the cleanup program.

The Air Force, which is the responsible party paying for much of the cleanup, funds the TRET. Moreover, some members of the TRET are employees of the regulatory agencies that frequently differ from the Air Force about specific scientifically based cleanup decisions. Nonetheless, this group of advisers has managed to maintain its objectivity and the perception of most, if not all, stakeholders that it is providing good advice based in sound science without undue influence—either from the funding organization or from the management of the agencies for whom some of the scientists work.

Bob Barrett, Collaborative Decisions, Menlo Park, California: The root problem here might be lack of trusted data or lack of trusted funding for gathering data. If the information appears complete to the parties, but the government agency and citizen groups need to develop confidence in it, then I would explore whether it would be possible to set up a fund to hire a trusted expert to study the data and report to them on its completeness and/or reliability.

If it appears likely that additional information or data gathering will be needed, then I would suggest that the group consider the value of having a committee from all sides develop a consensus protocol to guide a new group of experts in studying the problem or collecting data. One way of setting up a fund is to engage someone to act as a trustee of an account set up especially to collect funding; into this fund all parties would be asked to contribute in suggested amounts or whatever amounts they could manage. The trustee would not disclose to the parties what amounts had been contributed, but would report on whether the aggregate amounts contributed were sufficient to fund the studies or data-gathering efforts needed.

Such fundraising efforts could be done in phases (round 1 to support a general assessment of river water quality, round 2 to support a monitoring program, round 3 to support a more detailed search for sources of specific pollutants, etc.) and funded sequentially. If the amounts were sufficient, the studies would proceed. If not, the trustee would be authorized to notify the parties of that fact and encourage a further round of contributions, again without disclosing which parties contributed what amounts.

10. **Uncertainty and Division among the Scientists.** The Problem: In a conflict over the construction and routing of new transmission lines, an electric company cannot avoid bringing their lines through certain residential areas. Credible evidence is presented on both sides about electro-magnetic frequencies as a cancer cause.

    Gail Bingham, RESOLVE, Inc., Washington, D.C.: Consensus-building processes must be structured to help manage the inescapable fact of scientific uncertainty. Human understanding about cause and effect is incomplete, whether the decisions involve complex ecosystems or human health, and the future is uncertain.

    I encourage parties to invest in identifying what is known and agreed upon, where information is in dispute, and where there is a lack of information. It is possible that agreement on all the facts by all the scientists may not be needed to make decisions, in other words decisions may be possible within the bounds of what is known.

    In this example, I might create an information exchange forum, in which the parties would pose questions to panels of experts, so that each party can hear an interaction amongst the scientists. It is important in such processes to ensure that each party sees that someone in whom they place their trust is involved. The objective of such a forum would be to clarify where scientists agree, where they disagree and what the range of disagreement is.

    In some cases, the areas of uncertainty or disagreement turn out to be ones that can be

managed by risk mitigation measures. For example (and only hypothetically), if the disagreement in this case centered around certain frequencies or intensities above a certain level—with agreement that risks were low at other frequencies or levels—then the parties might be able to agree on monitoring measures that could allow both local residents and the utility to take appropriate action to avoid the circumstances in which they agree to disagree about risk.

Tom Fee, The Agreement Zone, Freehold, New Jersey: Another technique I would propose is to ask each participant to become translators of each other's reports and data. When there are extreme differences in levels of sophistication about technical issues or analysis, I would propose a day for orientation and training.

Many experts are not expected to translate their work for others. A safe way to encourage translation to the various audiences at the negotiation is to ask each person to work in teams with representatives from other groups to draft joint reports. This can help build respect for other points of view and helps to avoid discounting of adversaries' perspectives. The group also might hire a journalist or writer to summarize and present the competing reports.

11. **Distrusted Science**. The Problem: Local food producers propose to build a food irradiation facility to control insect infestations in export fruit and to reduce the risks of ***E. coli*** outbreaks. Anti-nuclear opponents organize to defeat it. They believe that the use of radiation will poison their food.

    Martha C. Bean, Mediator, Seattle, Washington: I believe the distrust of scientific information is almost certainly based on a fundamental difference over the right and wrong uses of radiation. This is a values issue; science is unlikely to change the mind of anyone. Agreement per se may not be possible. However, dialogue may be possible.

    If the parties agree, then we could design an exchange of information about how each side approaches the science that bolsters their perspective. My objective would be to have parties leaving the dialogue saying, "I still don't agree with them, but I understand why they believe what they do."

    I would ready myself for the possibility that one or both parties may not want to better understand each other's perspectives. In values conflicts, parties often want forums where they can "win", not just "be heard".

    My job as mediator is to understand why the science is distrusted. This can best be discovered through careful questioning in caucus with each party. "What is it about this information that keeps you from using/ believing/ hearing it?" Often it is not the science itself, but the source that is the issue. The research entity, or even the scientist, may be the problem.

    The same science may become acceptable after peer review by a jointly selected trusted third party. In a case I am working on, parties vehemently challenged basic assumptions used in the central modeling effort, resulting in a resounding distrust of the model results. Usually mild-mannered scientists got nasty and personal. A near fist fight broke

out at one meeting, further escalating the conflict and exacerbating the issue of how to get model results that could be "trusted".

We were able to make progress only after the scientists could say to one another, in the presence of their clients, that they understood the approach taken by the other, even if they respectfully disagreed. We carefully re-framed their differences over assumptions in order to allow the policy-level negotiators to resolve which assumptions should be used in the model. As it happened, it was unnecessary to take the dispute to the policy level.

After agreeing to disagree about basic assumptions, the scientists "ran the numbers" again using a jointly developed, back-of-the-envelope model and both sets of assumptions. Not surprisingly, the two different approaches yielded the same answer! Much storm, drama and distrust was generated over fundamental differences in approach, which ultimately had no bearing at all on the outcome of the negotiations.

The take home message here is that the mediator must help parties tease out whether or not their lack of trust regarding science is driven by personalities, values, sources, or misapprehensions over the significance of scientific differences.

Juliana E. Birkhoff, RESOLVE, Inc., Washington, D.C.: The conflict resolution process can be used to clarify issues, understand viewpoints, and establish rules of engagement. In this case, if the mediator were to construct a forum with the goal of consensus around the design of a safe food irradiation process, then the mediator would be taking sides. That is, the mediator would be constructing a process where the goals of some parties are privileged over others.

I would frame the issues broadly: How can we reduce the risks of ***E. coli*** outbreaks and enhance fruit production? What are the ways to increase economic stability and prosperity for fruit growers? What is the range of perspectives on nuclear use locally?

I would organize a series of small, facilitated dialogues with a representation of stakeholders in each dialogue. The goal of each dialogue would be to learn about each other's stories, interests and values.

Then I would organize a working group with representatives from all the working groups to develop a range of options about safe food production and economic opportunities for food producers. This working group would then disseminate their options to the media, government agencies, commercial associations, and legislative fora.

Bob Barrett, Collaborative Decisions, Menlo Park, California: There may be three or more root problems here: (1) that the science is sound, but not trusted; or (2) that the science is not sufficiently sound or clear in its implications; or (3) that the main problem is in the underlying values or ideology about how the existing science should be interpreted.

I would proceed, first, by trying to understand which of these root problems was most critical to address. Fishbowl presentations or background seminars by trusted experts not involved in the controversy at hand might be useful. University professors or retired

scientists from industry generally might be hired to fill the role.

Another approach might be to form a panel of scientists to conduct a test of radiation under the control of a committee composed of representatives from all sides of the controversy. The test would be conducted over a period of, say, a year, with action postponed until the test results are in.

It seems likely that the problem is a political one that is not subject to these approaches. In that event, there might be an effort to re-frame the issue to focus on achieving agreement on labeling requirements, so that parties who object to radiated fruit might avoid buying such products.

12. **Information Is Irrelevant**. The Problem: Government agencies and environmental groups sue several industries over the removal of PCBs from river sediments. There are major scientific and factual disagreements over the levels of PCB contamination that actually warrants action. There are also disagreements about the amount of sediment that has been deposited on the river bottom and bank? Plaintiffs and defendants agree to a settlement that results in a cleanup with no admissions of liability.

Mary Margaret Golten, CDR Associates, Boulder, Colorado: It may turn out to be true that researching or processing information really won't make a major difference to the outcome of the case. However, I would be reluctant to take the parties' word for this at the start. I would be concerned that later, after the case is concluded, one group or another may discover that what they had assumed to be the relevant PCB levels was critically different. Thus, the level of cleanup on which they had agreed could turn out to be too low. I would worry about the parties having "buyer's remorse" and feeling that they had made a hasty and perhaps untenable agreement based on inaccurate perceptions.

In order to avoid such a situation, I might try to slow down the process (which could cause resistance if the parties are rushing to a solution) and pose some scenarios to the parties. For example, if the contamination level or levels of sediment in the river were found to be X, Y or Z, then would the cleanup process change?

All parties would participate in developing and costing out several scenarios to determine whether the outcome would change significantly based on the input. A joint evaluation process of this nature, even if cursory, could provide a more secure foundation for a clean-up agreement.

If the parties discover a large disagreement on the approaches that each would take to clean up, then they may have to work harder to resolve their disagreements over data, rather than simply letting them go. On the other hand, if, after initial prodding from the mediator, all parties seem to be resolved to live with their data disagreements and are comfortable with their decision to move ahead without a detailed analysis the data differences, then more power to them! After voicing my concerns, I would certainly not get in the way of solutions.

Bill Humm, Environmental Settlements, Lee, New Hampshire: I am going to try an

approach that succeeded in a similar case I worked on that involved the voluntary cleanup of a municipal aquifer contaminated with hazardous waste. My task was to help a dozen Potentially Responsible Parties (PRPs) allocate cleanup costs. The usual practice of collecting "waste-in" data seemed unproductive in this case since records were spotty. Moreover, all parties maintained that they were minor contributors to the problem. There was nonetheless a desire to find a basis for settlement.

In a brainstorming session, I helped the parties design their own variant on the old "silent auction" technique. This process required each PRP to convey via the mediator a confidential "bid" reflecting a settlement offer.

I was also authorized to prepare a report to the PRPs reflecting the total value of the bids, the amounts of the highest and lowest bids, and certifying that all PRPs had submitted bids. Although the first few rounds of bidding fell short of the amount required for cleanup, the tool nonetheless built confidence among the PRPs that an acceptable allocation was within grasp.

I was able to reassure the PRPs that no one was "low-balling" and that one PRP (perceived by the others as being the major contributor to the problem) was making a bid proportionately larger than the others. Individual PRPs increased their bid in the subsequent round of bidding, based partly on their inference on what others were doing. Meanwhile, I encouraged each of them to focus on the value of avoiding lengthy litigation rather than worrying that one of them might commit fewer dollars than another.

With settlement close but still elusive, I convened the CEOs, several of whom no longer felt the need for the confidentiality of the bidding process. They openly acknowledged their bid and challenged the others to increase theirs. Within hours a settlement of the cost allocation question was achieved. Though the tool was crude, it was effective in this case, perhaps largely because the parties "invented" it themselves.

Greg Bourne, Mediator, Cave Creek, Arizona: Circumstances exist where political or economic forces overshadow the use of technical or scientific information to reach a solution. In certain cases, this will be the reality faced by participants in a conflict resolution process. However, even when political and economic forces may seem to prevail, there may be a way to use information more effectively.

First, when decisions are made for political or economic expediency, the decision is more likely to undergo increased scrutiny. In these situations, it may be necessary to determine a clear basis for decision making using the available information.

Second, tools exist that may help make data or information more relevant. For example, parties in a dispute about airport noise, and how to reduce it, initially might consider random noise level readings unusable, and therefore irrelevant to making a decision. However, a computer-based program exists that can help determine the noise levels associated with different jet engines. This program can simulate noise from different types of engines at different locations around an airport, thereby allowing very specific scenarios to be tested realistically. It can provide a tangible basis for decisions.

Ultimately, such tools may help participants place more relevance on using information

for decision making.

13. **Data Overload**. The Problem: Various industry and public policy groups are involved in a rule making negotiation over microbial disinfectants. The data on human health, microbiology, chemistry, water quality, and treatment makes the rule making process time consuming and very difficult because there is so much information and so many complex relationships between the different kinds of information involved.

    Abby Arnold, RESOLVE, Inc., Washington, D.C.: In the actual microbial disinfectant drinking water negotiated rulemaking, which is still in progress, we addressed this issue in three ways.

    First, we created a technical working group (TWG) made up of experts trusted by one or more federal advisory committee members. The role of the TWG was to advise on specific priority questions, sift the available data, conduct rigorous analysis, debate and discuss the analysis, develop consensus where possible on the results, and report their findings back. Where agreement is not achievable, the TWG lays out the areas of disagreement and why there is disagreement.

    Second, the TWG is developing very sophisticated models to sort through data and produce an analysis of data. These models and model outputs are being rigorously peer reviewed and tested for validation.

    Third, we are developing multiple ways to analyze data by separating tasks by substantive issue and hiring other technical experts to address specific questions. A small subgroup of the whole committee is also assisting with this process, but buy-in by the full advisory group on the technical expert is essential. The technical experts then review all available data and present findings to the advisory committee in the form of a detailed paper with references.

    Peter Adler, The Accord Group, Honolulu, Hawaii: In an analogous case over integrated resource planning (IRP) for potable water, we began our work with an exceptional detailed and lengthy substantive conflict analysis. This analysis identified all current sources of supply and demand; and projected demands based on demographics and growth, potential new sources of water, and areas of uncertainty (including new technologies such as desalinization, changes in water pricing, and ambiguous legal areas over the potentially superior rights of some groups). We also interviewed most of the potential stakeholder groups to gather their ideas on data needs and data gathering.

    This advance work provided the start of a critical information base at the front end and positioned the eventual IRP to accelerate its learning curve as the actual planning begins.

    Scott McCreary, Concur, Berkeley, California: In a similar case, a dialogue which focussed on understanding the sources, fates, and effects of PCBs in the New York Harbor Region, Marc David Block and I identified experts who had published peer-reviewed literature specifically on sources of PCBs in the Hudson/Raritan Estuary. We recruited these experts to form the nucleus of a "Sources Subcommittee" and teamed

them with a representative cross section of negotiators—at least one each from the port, manufacturing, environmental NGO, and agency regulatory communities. The mission of the Source Subcommittee was to synthesize and present available information on PCB sources in a form useful to the negotiators.

As preparation for a one day meeting, we caucused with several of the authors and reached two preliminary conclusions. The first conclusion was that the Subcommittee should strive to build a table reflecting a "PCB budget" for the ecosystem. The second was that the Subcommittee's work could be accelerated by identifying the most comprehensive study of the problem to serve as the foundation. Before the meeting, we compiled and distributed the peer-reviewed studies to subcommittee members.

The Sources Subcommittee agreed with the proposal to build a PCB budget, but insisted that there were two prior needs. One was to establish an appropriate threshold for including data in the table. The second need was to define a series of key terms—"reservoirs", "fluxes", and "losses"—to accurately define how the contaminant moves through the system.

Then the Subcommittee organized the data by reach of the system and the data was sorted by two time periods. Each data entry was keyed to either a published literature source or a specific personal communication. The Subcommittee drafted a series of overarching findings to summarize their work, and suggested a way to graphically represent their findings as well.

The mediation team compiled a draft document compiling the data into a single unified table and accompanying text. This document was presented to the Sources Subcommittee for another round of review before being finalized. It was presented to the policy negotiators for review, refined yet again, and incorporated in single text document.

14. **Theory Unsupported by Sufficient Research**. The Problem: After several cases of Mad Cow Disease, policymakers determine that there is a need to create regulations on the beef industry. Theories about the origins and transmission of the disease exist but there is almost no research available to inform the regulatory process.

David Keller, Mediator, San Diego, California: When the public health is deemed to be at potential imminent risk, government needs to act swiftly to assess the risk and implement all prudent measures. When no cause can be clearly identified, however, the government is in an obvious quandary. The challenge is to assist the scientific community to move quickly away from conjecture to fact finding.

My focus would be on gathering what facts do exist and confronting directly the lack of robust epidemiological data or proof of a causative agent. I would then facilitate a search for the "highest consensus possible" on short term and long-term regulatory actions.

Inevitably, there will be heated debate about competing hypotheses, experimental methods, instrumental analysis, statistical analysis, benefit-cost analysis, uncertainty analysis, and ultimately, "the best" plans for further research and regulatory action. While my

role will probably be more facilitative than evaluative, I think it would be essential that the mediator (or a co-mediator) also be a scientist trained in both the quantitative and qualitative methods.

Christine Carlson, Policy Consensus Initiative, Santa Fe, New Mexico: I would conduct a conflict assessment, and, as part of it, I would talk to scientists as well as other stakeholders. Assuming this is a federal agency, I want to query both the program and research staff and any of the stakeholder groups with expertise on this issue. I would have them respond to the following scenarios:

- The agency does nothing and there is another outbreak of Mad Cow Disease that excites reaction from the media and the public. How will that affect you?
- The agency begins sponsoring research to determine the cause and control of mad cow disease, but does not issue regulations. In the meantime, another outbreak occurs, causing a strong public reaction. A reporter calls you for a response. How will you respond?
- The agency begins sponsoring research to determine the cause and control of mad cow disease and at the same time proposes to begin a process to consult stakeholders in the development of regulations. How will you respond to their request that you participate in the development of regulations?
- The agency promulgates regulations without input from the stakeholders. What will you do? What will need to happen for you to accept the need to regulate? What kind of regulation, if any, could you accept?

Following the assessment, I would report back to the stakeholders the results of the assessment. I would then suggest a meeting for them to explore the alternative approaches they have suggested.

15. **Scientists Ahead of the Stakeholders**. The Problem: State park officials concerned about the ecological impacts of recreational uses on a coastal island organize a series of scientific inquiries. After concluding their studies, the park officials gather together a stakeholder group that quickly identifies other kinds of data that are needed for regulation. Park officials have no budget left for additional data gathering.

Lucy Moore, Lucy Moore Associates, Albuquerque, New Mexico: Let's start by inviting rich people to the party. You need data and there is no money left in the budget for it. Ask yourself, who else needs to be part of this process? That is, who has money and/or data? Invite them to join the process, or perhaps create a Data Collection Committee, and stick them on it. Find people that know the Internet and how to use it.

Make sure these people do not run away with their power, and forget that they are the servants of the group. [In Santa Fe, a local foundation paid $ 300,000 for an administrative audit of the school system, to try to help resolve a huge battle between administration, board and community.]

I would also look for free help. Have your group make connections with local schools

and universities, or even elementary and secondary schools. Find a graduate student needing a topic for thesis, or needing some field experience. Sixth graders in Santa Fe have become excellent water samplers, and junior high kids are building wetlands downstream of the wastewater treatment plant.

"Adopt a school" and make them part of your project. Chosen students will get to come to your meetings (ugh!) and see how the adult world works. You can recruit some data collection help in the field or on the Internet; kids can be very useful. They can also bring a sense of calm and dignity to a group of adults, who otherwise might tend to bitch and whine at each other.

Abby Arnold, RESOLVE, Inc., Washington, D.C.: A major challenge when mediating processes where the scientific community intersects with policy makers and affected parties is when the science used for policy development is developed separate from the stakeholders. My response to this is to have to go back two or three steps in order to move ahead.

Even with science completed, stakeholders need to be engaged in developing the questions that they think are important to answer. This would include the sponsoring agency or organization and this is that organization's opportunity to persuade other stakeholders what questions they think are most important (thereby validating the questions researched).

Stakeholders then need to have a say in who will conduct the research and what methods are most appropriate. If the negotiation is convened after the research is conducted, then the sponsoring researcher or agency needs to walk through a deliberative discussion about what research was conducted, what methods were used, and offer why these methods were the best to use in this situation. Parties need to buy into the methodology or else their trust in the results is compromised.

If parties do not buy into the questions or methods used options for how to address this distrust of the data needs to be incorporated into the process and/or possibly any recommendations that result from the group. For example, parties may ask for technical assistance to develop an alternative method of analysis and see if that makes a difference to the conclusions drawn from the data. Or the final recommendation could include suggestions for what research questions should be addressed in the future, what methods should be used to conduct the research, and how to incorporate stakeholder input into the research in the future. Additionally, it is useful to include stakeholders in a discussion about who will conduct research, and what is the most useful way for the science to be reported back to the group.

Workshops where the public can engage with researchers to refine the questions to be answered and methodologies to be used have been helpful.

Another option, is that if the research is completed and there are no options for additional research during the time of the negotiation is to find scientists that the parties trust to teach/work with affected stakeholders about why the science conducted is sound is an alternative. This trusted advisor(s) can be made part of the mediator team and be brought in at various times throughout the process.

16. **Information Not Yet Usable**. The Problem: A community pressures the commander of a military installation to clean up a disused training area that has unexploded World War II ordnance below ground. Old methods of cleanup would damage environmentally and archeologically valuable sites. The military and the community agree on the goals and priorities for cleanup but the specific techniques needed to do a low-impact cleanup will not be available for another eight years.

Fisheries biologist Alisa Abookire studies interactions between the marine environment and fish distributions. She is interested in the effects of temperature on habitat quality and seasonal distributions of juvenile fish, especially smelts. Smelts and other forage fish represent an important link in the marine food web. They transfer energy between primary and secondary producers, such as plankton, to top predators such as seabirds and the King Salmon, shown here. Courtesy, U.S. Geological Survey.

Gail Bingham, RESOLVE, Inc., Washington, D.C.: In this situation time appears to be the variable causing problems. I might encourage parties to develop criteria for separating what they feel is urgent now and what can wait. They then may be able to approach urgent and less urgent problems differently.

For the former, they may have to weigh the benefits of solving the urgent problems against the adverse impacts of current technology on other values, such as the archeological and environmental resources mentioned. If the immediate risks are urgent enough, they may be able to agree on mitigation measures for the resources that will be damaged, or if the resources are valuable enough they may decide to move the people who are at risk.

For less urgent problems, the parties may be able to agree on monitoring measures to maintain confidence that the risks aren't increasing and to invest in the new techniques on the horizon. I helped mediate a process to re-license two hydroelectric dams. The parties faced a similar challenge regarding the need for additional information and creative technological solutions for mitigating against gas bubble disease in fish. They structured their agreement around principles of adaptive management so that they could continue to gather data to understand how the hydraulics of one dam was causing elevated nitrogen levels in fish so that, in turn, they could evaluate what solution actually would work.

Bob Barrett, Collaborative Decisions, Menlo Park, California: The problem here is timing. What can be done on the current priorities before better-anticipated methods

become available years in the future? This may be a case in which to use joint fact-finding.

First I would help the parties agree upon a set of criteria for the determinations to be made. Then I would ask the community representatives to identify and list their highest to lowest priority areas for cleanup. I would then look to the military representatives to identify and list the methods currently available for cleanup and new methods expected to become available over the coming years.

These sessions might be in caucus or joint, depending on the level of trust within the group. Then, using a single-text approach, I would work with the parties to merge the two lists, setting aside for further discussion any items of disagreement. I would expect to return to the list of items of disagreement after the parties had built greater trust in each other and in the process.

The process might contain provisions for meetings periodically (for example, annually) to assess progress and make new decisions about how best to merge the lists of priority areas for cleanup and cleanup methodologies.

17. **Poor Issue Framing**. The Problem: Officials from a well-regarded research institution propose to build a large, multi-million dollar infrared telescope on the top of a mountain that is used by local hunters and hikers and held sacred by native people. The scientists are prepared to address mitigation but insist on using standard western scientific nomenclature and criteria for mitigation plans. Representatives of the native people do not believe their issues are being adequately discussed.

Martha C. Bean, Mediator, Seattle, Washington: Most mediators have story after story about conducting conflict assessments only to discover that the issue as presented to them by the convening organization is very different from the way other stakeholders wish to approach it. This is particularly true in environmental cases, where conveners often frame an issue as a narrow scientific problem to be solved, while others describe larger ¾even societal¾choices or values. Until and unless the parties have the same concept of what is under discussion, there can be no engagement.

In the situation described above, the issue of framing is enmeshed with cultural differences and values, and historic uses of the site. I would have all parties to spend at least a day together, each of them telling their stories about how important¾even precious ¾ the site is to them. Each group would have the same amount of time, probably several hours, where other parties could ask questions but not assert their own views.

I would encourage them to walk together on the site, to touch things, to look at pictures, to listen, to view the sky with the naked eye and with telescopes. The scientists need to get a glimpse of the religious importance of the mountaintop; the native people may not know that learning about the heavens is more than a job for the scientists. The recreationists need to convey what is like for them when they hunt and hike the mountain.

The objective of this day would be to allow the issue to be re-framed to accommodate

what is most important to each group. Under this scenario, it is possible the issue may be re-framed so that not building the telescope is on the table.

A caution is in order here, and it is about power. If the research institution has the power to build the telescope regardless of what others think or want, then it does not need to incorporate the interests of others in order to achieve their desired outcome. It would be counter-productive and disingenuous to even suggest that the issue could be re-framed to include the question of whether or not to build the telescope.

If this is the case, the mediator should help the project proponent say clearly and honestly, "We will build a new telescope." "We'd like to do this in a fashion that respects the needs and interests of other people who use, love and know the mountain. Will you help us figure out what it might look like to do this?"

Tim Mealey, Meridian, Washington, D.C.: The phenomenon of poor issue framing is probably the most common yet vexing issue in any public policy dispute or problem-solving situation. In the example posed, the scientists who propose building the telescope "insist" upon using so-called "standard western scientific nomenclature and criteria".

One of my first tasks would be to understand the legal and political context that would lead them to "insist" upon anything. There are numerous laws that many people are unaware that establish rights for native peoples to protect sacred sites or to allow for freedom of religious practice that may be a part of the backdrop of the case. Even with out such rights being a factor, it may very well be a part of the political dynamic that must be considered.

Thus, I would begin by pushing back, albeit gently but "insistently" on those who wish to limit or control the framing of the issues. Eventually, this should lead the parties to more fully understand each other's "BATNAs", which of course is a useful step in any case.

Assuming I was successful in getting the reluctant parties to agree to a reframing of the issues to include issues the native people believe should be considered, there are numerous conventional and unconventional techniques that could be used to build understanding about those issues. These include site visits and story telling.

18. **Pseudo-Professional Posturing.** The Problem: In settlement discussions over pollution damages, a lawyer exaggerates his grasp of the hydraulics involved in the migration of underground contamination. In those same discussions, scientists retained by the community are arguing constitutional questions.

Elaine Hallmark, Hallmark Pacific Group, Portland, Oregon: I use an approach that I would call "validation and redirection". Basically I try to validate the individual's concern and the attempt to bring out information on a difficult issue. Then I would take one of two approaches (or possibly try both).

The point is to break up the dynamic and attempt to address the real underlying inter-

est. It may also help to acknowledge that this process is unlikely to resolve all the technical and constitutional ambiguities.

One approach is to pull the group as a whole into a conversation about what is needed on this topic. Do we need more or different technical information before we can proceed? Do we need to structure a discussion with neutral experts on these issues? (Validate the pseudo expert by saying things such as, "I know you know quite a bit and are trying to bring in the challenging questions, but perhaps someone who has the credentials in this area could help all of the parties.")

The other approach, which I might choose to use first, is to caucus separately with the "competing pseudo experts" and explore with them what their concerns really are. Some reality testing about the likelihood that they can actually convince the other party or make them feel they have a weak argument with this approach. Getting at the bottom of whether the approach is tied to insecurity, a lack of information, or a procedural tactic on their part will help decide the next best step.

Finding another way to bring in the expertise, whether for the one party or for the group, as needed, will address an insecurity or lack of information. If it is a procedural tactic, you as the mediator can brainstorm with them other procedural approaches to convey their views and raise parties' awareness of the weaknesses in their arguments.

Howard Bellman, Mediator, Madison, Wisconsin: This is a situation where the mediator needs to work with his or her intuition about the relationships and personalities in the situation. In caucus, I would confront it-I would say "This is bullshit, you know it and I know it and you need to get off of it."

I would describe to the person the consequences to their BATNA of maintaining their façade. You need to obviously choose your language carefully depending on whom you are talking to but you need to identify it for what it is.

19. **Shifting Conceptual Framework**. The Problem: Global warming scientists and policy makers have gathered to develop proposed policies that would dramatically effect business economics. Environmental advocates argue for stringent regulations to prevent ozone depletion and the buildup of greenhouse gasses. Representatives of major industries object.

    Gail Bingham, RESOLVE, Inc., Washington, D.C.: People never know everything they want or need to know in making decisions and efforts to understand the world continuously produce both new information and new ways of thinking about how organisms and ecosystems function. Although taking time to invest in new learning is often preferable, postponing decisions may not be an option or may, in fact, be a way for one or more parties to win over others.

    I often recommend that parties take a phased approach to resolving the underlying issues and encourage the parties to maintain their interactions so they can obtain and integrate new knowledge collaboratively. Essentially, we did this in a public health regulation I mediated several years ago where the dynamics were similar. The agreement laid out what the parties could concur on based on existing knowledge, articulated

the scientific assumptions on which the agreement was based, outlined specific information collection and research steps, and committed the parties to a subsequent negotiation at a fixed time in the future.

Peter Adler, The Accord Group, Honolulu, Hawaii: This is the kind of issue that creates multiple negotiations at many levels and in different places. Part of the challenge lies in the fact that it is impossible to get simultaneous or sequential agreements in the multiple forums that are involved.

One version of this is the kind of regional and international environmental accords developed at the Rio summit several years ago. There are other efforts going on at this moment among Pacific Island nations who will probably be the first and most heavily impacted by sea level rise.

If I were called in to try and develop a fresh approach, I would explore a more informal or Track-II process organized around receptor/risk-based impacts. The mission of the process would need to be kept modest and a key part of my job will be to lower everyone's expectations. If it doesn't come from others, I am also going to be quite insistent on the use of high quality peer-reviewed research, GIS, digital mapping, and modeling as a way of building the strongest possible information base prior to solution-seeking.

20. **Unrealistic Expectations of Scientists**. The Problem: Environmentalists, farmers, loggers, and government officials are engaged in an acrimonious planning problem, one aspect of which is the adoption of in-stream flow standards. After a round of initial meetings, the working group engages a group of scientists who cannot give them a single answer.

    Kem Lowry, Department of Urban & Regional Planning, University of Hawaii: Technical disputes, such as those involving the potential biological impacts of proposed in-stream flow standards, can sometimes be addressed through processes that involve close examination of the causal assumptions of analysts and commitment to a contingent approach to standard setting.

    I would first urge analysts to participate in a process of cognitive mapping; to specify their assumptions about causal processes that link different in-stream flows to biological impacts. Software now exists which facilitates mapping causal processes, but pencil and paper diagrams are adequate. Once analysts agree that these "maps" adequately reflect their assumptions, they can be compared and areas of agreement and disagreement can be specified in more detail.

    Abby Arnold, RESOLVE, Inc., Washington, D.C.: Adjusting expectations about what the technical experts will be able to offer, up front with all parties is an important first step. You can do this by asking parties to give the scientists or technical team instructions to see where they can agree, or to see where there seems to be a preponderance of evidence, and then to clearly identify for the negotiation committee where differences in interpretation lie and what are the differences, and why those differences are important.

Question scientists about what criteria they use to determine whether there is one answer. Offer the parties bounds of error or confidence levels in the original data and interpretation of the science.

Another tool is to offer parties comparisons of differences in data analysis: simple matrices comparing using different assumptions. The assumptions need to be noted clearly up front

The mediator role is to up front help parties understand what they can expect from the scientific community, to review documents before they are brought to the parties to make sure they are clear and understandable, and that differences in data interpretation are clear. The parties need to understand what the science offers, the importance of differences in interpretation, and to whom. The parties then have to make the hard policy decisions.

21. **Outdated Data & Organizational Lag.** The Problem: Small businesses that rely on a specific technology believe that a constituent metal should be de-listed as a toxic substance because new research indicates it is not a public health threat. De-listing would translate into economic efficiencies. The government agency responsible for small business sees this as a low-priority issue. They are willing to meet but not willing to take it up on their docket of rule-making issues.

Kem Lowry, Department of Urban & Regional Planning, University of Hawaii: This problem is really about power and leverage. Getting a government regulatory agency to change its priorities requires effective advocacy.

If I were assisting a stakeholder group in grappling with this issue, I would caucus confidentially with the industry and business groups and explore their finding a "broker" within or outside the agency who might advance their argument that de-listing silver is low-risk and cost-effective.

In private, I would also raise a second, complementary strategy: creating a de-listing constituency to lobby the agency. A particularly credible advocacy group might be composed of traditional adversaries in toxic waste regulatory forums. A group that includes small business advocates specialists on toxic materials and representatives of consumer and environmental health groups would be viewed as particularly credible.

A third strategy to be explored is to do the agency's work for them by simulating a rule-making process. Representatives of relevant interest groups and the regulatory agency could be convened to engage in a facilitated rule-making process on silver. Such a process would reveal the substantive, economic and political issues to the agency.

Failing all appeals to reason and "good government," I might see if they have considered making contact with an ambitious producer at "20/20" or "60 Minutes" to encourage a segment on how government inertia and over-regulation is harming small business interests. If they didn't come up on their own, I would raise all of these ideas through questions.

Bob Barrett, Collaborative Decisions, Menlo Park, California: This appears to be a problem of how to motivate a bureaucracy. There may also be a problem with one agency being responsible for promoting small business and another agency being responsible for environmental protection and their priorities may not coincide. Advocacy or behind the scenes political action may be necessary.

I would meet with the small business parties and counsel them on the options available. Perhaps it might be possible for a trusted person to approach the agencies and try to persuade them to consider aligning their priorities. Or perhaps ask a third agency to convene a meeting with representatives of the affected agencies and try to persuade them to take up the necessary rule making. Or perhaps one agency could grant special permission to use the constituent metals even before the rule making, with protection from prosecution for violation of the environmental regulations.

Doug Yarn, School of Law, Georgia State University: There are many variables affecting the strategy for the acquisition of restricted data. For example, to what degree is the possessor of the data a participant in the process, or is the possessor unrelated to the process entirely? Does law require the restriction on the data, or does the possessor have discretion over revealing it? Is the restriction permanent and on going, or is it temporary, wherein the data will eventually be available?

Assuming for the moment that law does not restrict the data and the possessor is a participant in the process, one strategy is to use non-disclosure agreements. Participants in the process agree that they will not reveal the data to anyone outside the process. The person possessing the data would have to decide if such an agreement sufficiently protects their interests in the data.

A violation of the agreement would trigger some pre-determined liquidated damages or carry some civil penalty. Clearly such agreements are easier to obtain and enforce when there are fewer people at the table and when the representatives for larger constituencies are authorized and sufficiently trusted to make decisions regarding the data without sharing it with a large number of constituents.

Another strategy is to use the facilitator, mediator, or other neutral third party as a confidential repository of the data. The data would be revealed to the third party under the conditions that specific details—the revelation of which would undermine the possessor's interests—would remain confidential. However, the third party could advise or make recommendations to the plurality of stakeholders based on that third party's assessment of how the data affects the problem or options.

This strategy works best if the parties have considerable trust in the third party's ability to protect the proprietary interests in the data while simultaneously making useful interpretations of the data for the decision-makers. In highly technical matters, an expert neutral fact-finder may be best person to perform this role, either independently or in collaboration with the facilitator. This quasi-arbitral procedure would result in a non-binding recommendation in light of the data. Examples of this can be found in ADR procedures used to resolve commercial disputes over trade secrets and patents.

Certainly much depends on how amenable the data is to this mechanism. Also, this strategy works well if the third party is needed merely to determine whether the data is relevant.

If the matter is in litigation, another strategy rests on the possibility of using a court to provide an opportunity for in camera proceedings, essentially closed-door inspection of the data under the court's supervision. There may be circumstances in which one of the stakeholders could force revelation through legal action. Such an adversarial approach might undermine attempts at a collaborative dialogue; however, the possessor of the data may willing submit to in camera proceedings if they perceive that the court would provide better protection.

22. **Differential Tolerance for Complexity.** The Problem: In a technically complex and long-running rule-making case over synthetic chemicals in food, scientists must analyze many different kinds of medical and public health data. They are insulted when busy, lay participants in the negotiation begin asking for a synthesis or the "short version". Conversely, the lay participants are running out of time, money, and the patience needed to engage in the process.

Elaine Hallmark, Hallmark Pacific Group, Portland, Oregon: I think this is a good situation for task groups of some kind. I often try to have a group agree to have the scientific or technical folks, possibly including those other parties, who have a penchant for the details, form a task group to really talk through and understand the data.

I believe it is often helpful for the facilitator to assist that task group, depending on the level of cooperation among them, and depending on their ability ultimately to synthesize the information in such a way that the "bottom line" implications of the data can be brought back to the full group.

The key to this approach is getting the right people on the task group so that the scientists do feel heard and validated, limiting the cost of the task group, and getting something useful back to the key decision-makers in the process. I have had good results with charging the task group to come together on a tool (often a table, a chart or a graphic) that integrates and summarizes the data in a way that helps the group walk through the decisions it needs to make.

I've had some experiences with the tool being a model that was like a board game with movable pieces, so various alternatives could be visualized by moving the pieces. Each piece has synthesized a lot of data related to that item. It may have rules with it. For example, certain pieces cannot be put with others, or, if they are, they add something else.

Tim Mealey, Meridian, Washington, D.C.: In many public policy dialogues and regulatory negotiations, it is not only helpful but also necessary to separate the technical/scientific issues from the policy issues. Often separate subgroups are formed to make sure both types of issues are being addressed adequately, with certain people taking on the role of translator between the two groups.

Essentially, there is no getting around the fact that there are differential needs and capabilities amongst the wide variety of stakeholders, decision-makers, technical experts, and laypersons that are involved in the formation of public policy. In addition to structuring the process to account for these different needs, some of the techniques I have used to address "differential tolerances for complexity" include briefings, training sessions, and educational efforts in the beginning of a process.

It may also be helpful to have the technical experts distill the crucial information for policy makers and/or members of the public who have a stake in the outcome of the process. If the technical experts become insulted by a request to do so, I might call a break or in some other way have a "reality check" conversation with them. I would converse about what it takes to make well-informed and carefully balanced public policy decisions, and the critical importance of the timing factors in the particular decision-making process in which they are involved.

23. **Pseudo-Scientific Environmental Conflicts**. Problem: The construction of a municipal solid waste incinerator is opposed by abutting neighbors who fear a drop in property values and increased (but nonetheless legal levels) of noise and traffic. Because the legal policy framework recognizes human health concerns, but not "inconvenience", as a legitimate basis for a negative decision, the community files suit alleging a deterioration of air and water quality.

Howard Bellman, Mediator, Madison, Wisconsin: This situation is as common as dirt. What the mediator needs to do is surface the parties' real issues. With government agencies the real issues might be policy. With businesses the real issues might be economics. With homeowners the real issues might be aesthetics.

The issues are very important, but they end up having to take a legal position to get their interests heard. The first thing I would do, in caucus, is to get people to say out loud what all their real concerns are. I wouldn't ask them to confess that they don't really care about the legal issues but to identify what all their issues are.

Then I would get them to talk about priorities. There is a possibility that if some of the core issues were addressed then the other ones, the more legalistic positions, would fall away. Since they have identified these issues publicly, the process will have to address both their formal public positions and the interests you identify in public. But unless you get all the interests out, then they have just put themselves in a corner.

Gregory Sobel, Environmental Mediation Services, Sudbury, Massachusetts: Parties appropriately use whatever forums and arguments will advance their interests. Most forums recognize only certain interests presented in particular ways. Thus, parties are forced to match their arguments to the forum.

If I am mediating a dispute raised under environmental laws, the parties will have crafted their arguments in terms of legally cognizable positions, often with an environmental handle. In private, I will ask the parties to articulate their real needs and interests, aside from the formal arguments they have made. If they can develop the terms of an agree-

ment that meet those real needs, the settlement usually can be structured to fit the requirements of the forum.

Sometimes the central term of the settlement is entirely outside the formal positions of the parties. For example, in a typical dispute I mediated under state and federal wetlands protection laws, the opponents of a proposed development argued that the wetlands hydrology would be illegally altered when what they really wanted was to stop a building that would block their view. The settlement involved modifications to the construction plans so that the cherished view would be protected. The plan changes had nothing at all to do with the legal requirements but by agreeing on the design change, the project opponents dropped their appeal and the developer, through a binding side-agreement, promised to build the development as agreed in the mediation.

Thus, pseudo-scientific and pseudo-environmental conflicts can sometimes be resolved, first, by identifying the true concerns of the parties; second, by crafting terms that meet those concerns aside from the legal arguments and third, by fitting the settlement into the rules of the forum.

End Notes

[1]This project began in February 1999, when Peter Adler, Ph.D., a Senior Fellow at the Western Justice Center Foundation and a Senior Consultant at the U.S. Institute for Environmental Conflict Resolution (USIECR), initiated discussions that involved Ninth Circuit judges, USIECR staff, lawyers and environmental advocates in Hawaii and elsewhere. Together, they focused on ways to strengthen the use of scientific and technical information in the mediation of complex environmental disputes. A focus group convened in April 1999 in Tucson, Arizona, and reaffirmed the need for a statement of mediator principles and practices.

The dialogue initiated in Tucson continued at the Society of Professionals in Dispute Resolution Environmental and Public Policy Sector meeting in May 1999 at Keystone, Colorado. There, Chris Carlson and Adler facilitated a discussion with other mediators on this topic. That session generated additional interest and many specific ideas for further exploration. Following that session, Bob Barrett, Martha Bean, Juliana Birkhoff, and Emily Rudin joined in the formation of a working group to capture the emerging best practices from the field. Connie P. Ozawa, author of one of the central works of the field, ***Recasting Science***, joined the group in June.

The Western Justice Center Foundation next hosted a focus group in Pasadena, California, in August 1999. The Hawaii Justice Foundation hosted a third focus group in Honolulu in October 1999. RESOLVE, Inc., in Washington, DC, convened a final focus group in January 2000. Each of the four focus groups included attorneys, mediators, facilitators, scientists, engineers, planners, public agency staff, environmental advocates, and journalists. Each group discussed specific cases and explored how science and technical information was or was not used in the process.

Over the course of these four meetings, the Working Group concentrated on four main lines of inquiry:

1. Rocks in the Road—clarifying the current understanding of specific science and technology problems that mediators and facilitators encounter;
2. Key Concepts and Guiding Principles—teasing out foundational concepts that underlie the interventions and processes that mediators and facilitators really use;
3. Rules of Thumb—developing and organizing a list of the strategies and approaches that mediators say they use; and
4. Practice Tips—gathering specific tools, techniques, and tactics for addressing the problems identified in (1) above.

In March 2000, thanks in great part to support from the U.S. Geological Survey (USGS), the drafting group met in Menlo Park, California, to discuss the document with Dr. Herman Karl and other USGS scientists. There, they planned to finalize and disseminate the report.

Jonathan J. Hutson, J.D., Communications Director of the Western Justice Center, edited the report. He collaborated with Steven Brehm, the Center's Webmaster, on the graphic design and production.

[2]We are especially grateful to the individuals who attended four day-long roundtable discussions on this topic in Tucson, Arizona; Pasadena, California; Honolulu, Hawaii; and Washington, DC; to Dr. Herman Karl, Homa Lee, Michael Fisher, Steve Vonderhaar and the USGS for their support and assistance during the final editing phase; and to Gail Bingham, Kirk Emerson, and Bill Drake, respectively, the Executive directors of RESOLVE, Inc., the United States Institute for Environmental Conflict Resolution, and the Western Justice Center Foundation, for their unflagging support and sponsorship.

[3]Ms. Christine Carlson, Esq., Executive Director of the Policy Consensus Institute, developed the concepts of Upstream and Downstream.

[4]Winfred Lang in "A Professional's View" (Culture and Negotiation, Guy O. Faure and Jeffrey Z. Rubin, editors, Sage Publications, 1993) offers the following examples:

Indices	*Engineers*	*Lawyers*	*Economists*	*Politicians*
Cultural Values				
Believe in:	The laws of physics	Statutory laws	The laws of economics	The law of survival
Have respect for:	Technology, computations, materials, designs	Authority, precedent, the sanctity of contract; rules in general	Theories and statistical data	Patrons, parties, and partisan loyalty
Cultural Perspective				
See themselves as:	Builders and problems solvers	Defenders of justice, partisan advocates	Planners and policy advisers	Defenders of the public interest; mediators, ultimate decision makers
Express themselves through:	Numbers and works	Technical words and documents	Money	Approvals and directives
Suspicious of:	Timely project implementation and worker performance	Parties' good intentions and pledges	Socio-political variables	Rival bureaucrats and ambitious subordinates
Negotiating Style				
Team role(s):	Leader or technical specialist	Leader, spokesperson, technical adviser, or excluded	Leader or financial adviser	Leader
Negotiating focus:	Technical specifications	Parties' rights and duties	Costs, prices, payments	Satisfying superiors, avoiding criticism
Future concern:	Project implementation	Conflict resolutions	Cash-flow risks	Project completion
Communication style:	Precise and quantitative	Precise and logical, but perhaps argumentative	Technical and conservative	Cautious and self-protective

[5]The Precautionary Principle and Reasonable Risk are terms that are still being defined. Considerable debate is taking place over how the two should be balanced. Reasonable Risk is premised on the notion that public decision making (legislative, regulatory, and adjudicatory)

requires judgements based on tested risk assessment procedures. Advocates of this approach believe that most important environmental decisions can be studied, quantified, and weighed through the use of scientific and analytic tools. Proponents of the Precautionary Principle argue that when an activity appears to present threats to human health or the environment, precautionary measures must be taken, even if cause and effect relationships cannot be established to scientifically acceptable levels of accuracy.

[6]Though cast as hypothetical situations, most of these examples are based on actual cases that have been modified to illustrate common science-related dilemmas that environmental conflicts present.

[7]In her 1991 book, ***Recasting Science: Consensual Procedures in Public Policy Making***, Connie Ozawa writes: "Whereas the objectives of science may be to attain truth, individual scientific undertakings represent only tiny steps toward truth. Knowledge gained through the scientific method is the accumulation of bits and pieces of reality, voluminous but incomplete, and mediated by the collector. Competing visions of scientifically derived truth can, and often do, coexist."

[8]There is considerable scientific uncertainty about natural processes in time and space. Scientists strive to reduce uncertainty through experiments to understand the physical processes at the local scale. The uncertainty in the natural process model increases from the local scale to the regional scale, because of the variability, complexity, and non-linearity of natural systems. For these reasons, many scientists are reluctant to extrapolate from local to regional scale. In addition to variability, incomplete information and disagreement among scientists contribute to uncertainty. Scientists endeavor to reduce the uncertainty in their models by collecting more data, which is a deterministic approach. However, additional information does not necessarily result in consensus, or reduce uncertainty, and could actually increase uncertainty, because scientists may disagree on the interpretation of the data, and more data may raise more questions.

[9]See "Resolving Science Intensive Public Policy Disputes: Reflections on the New York Bight Initiative by Scott McCreary" in The Consensus Building Handbook by Lawrence Susskind, Sarah McKearnan, and Jennifer Thomas-Larmer, Sage Publications, 1999, pp. 829-858.

[10]Sometimes, science is used tactically by one or more parties to gain leverage. In the snail darter case, a small, endemic, and localized fish became the means for stopping the construction of a large dam. The fish was listed as an endangered species, which transformed a values dispute about growth and growth management into an endangered species dispute.

[11]Some philosophies of mediation hold that parties are better served by a transformational approach to mediation (as distinguished from approaches that primarily emphasize problem solving). See, for example, ***The Promise of Mediation*** by Baruch Bush and Joe Folger.

[12]The terms Daubert hearing and Daubert test derive from a U.S. Supreme Court case (William Daubert, Et Ux., etc., et al., Petitioners v. Merrell Dow Pharmaceuticals, Inc., Certiorari To The United States Court Of Appeals For The Ninth Circuit, No. 92-102, decided June 28, 1993). Daubert and a follow up case (Kumho Tire) is the new standard for admissibility of scientific and technical evidence at trial. The standard requires a rigorous but flexible analysis

that must be applied to the facts at issue. Considerations bearing on the Daubert test include whether a theory or technique in question can be (and has been) tested, whether it has been subjected to peer review and publication, what its known or potential error rate is, the existence and maintenance of standards, and whether the proposed idea has attracted widespread acceptance within a relevant scientific community. The inquiry is a flexible one, and its focus must be solely on principles and methodology, not on the conclusions that they generate.

[13]For excellent resources in scientific visualization, see Tufte, E. R. (1997). ***Visual explanations: Images and quantities, evidence and narrative***. Graphics Press. See also Tufte, E. R. (1983). ***The visual display of quantitative information*** (1983). Graphics Press; and Tufte, E. R. (1990). ***Envisioning Information***. Graphics Press. Edward R. Tufte is a Professor of Political Science & Statistics at Yale University, where he has also taught in the Department of Graphic Design.

Appendix A.
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An Excerpt from the Preface:

"This document is an initial attempt to distill and disseminate those key principles and practices that are relevant to managing scientific and technical information in environmental conflicts. Through this project, we hope to advance both the practice and theory of environmental mediation and to launch further thinking and discussion on the issues raised."

"The information age has increased the pace of information development, dissemination, and application. As more scientific information enters the public domain, it is increasingly important to use science wisely and to understand its interactions with other modes of thought and inquiry. We hope this sourcebook will be helpful to that end."